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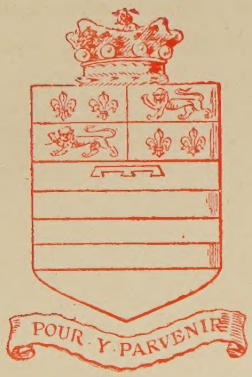

EDITED

BY THE

MARQUESS OF GRANBY

AND MR.

GEORGE A. B. DEWAR

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Old Forest Oaks.

OUR FORESTS AND WOODLANDS

BY

JOHN NISBET

AUTHOR OF

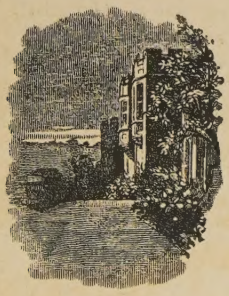
'THE FORESTER'

'BRITISH FOREST TREES,' 'STUDIES IN FORESTRY'

'BURMA UNDER BRITISH RULE'

AND OTHER WORKS

NEW AND REVISED EDITION



LONDON

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1909

'*No tree in all the grove but has its charms,*
Though each its hue peculiar; paler some,
And of a warmish grey; the willow such,
And poplar, that with silver lines his leaf,
And ash far-stretching his umbrageous arm;
Of deeper green the elm; and deeper still,
Lord of the woods, the long-surviving oak.
Some glossy-leaved and shining in the sun,
The maple, and the beech of oily nuts
Prolific, and the lime at dewy eve
Diffusing odours: nor unnoted pass
The sycamore, capricious in attire,
Now green, now tawny, and ere autumn yet
Have changed the woods, in scarlet honours bright.'

—COWPER, *The Sofa.*

PREFACE

'*I speak only here as a plain* Husbandman, *and a simple* Forester, *out of the limits whereof I hope I have not unpardonably transgress'd.*'—EVELYN'S *Sylva*, 1664.

'*There is no way under the sun so probable for improving our land as inclosing and planting the same. Therefore I wish it were effectually put in practice!*'
—JOHN REID, *The Scots Gard'ner*, 1683 (*concluding words*).

SINCE the first edition of this book appeared in 1900, as one of the volumes in the Haddon Hall Library series, certain preliminary steps have been taken by Government for the improvement of the lost art of British Forestry.

In 1902 a Departmental Committee was appointed by the Board of Agriculture to report on this subject, but the report submitted confined itself mainly to recommendations concerning grants-in-aid for providing technical instruction in Forestry at collegiate centres, the acquisition of a large woodland area as a 'demonstration forest' in Scotland, and the formation of Working-Plans for some of the Crown forests in the south of England. Although this Committee took note

of 'the great area of waste land in these islands which might be afforested,' yet it made no specific recommendations about their Afforestation, but merely remarked that 'we do not feel justified in urging the Government to embark forthwith upon any general scheme of State Forests under present circumstances.' Even if funds had been available for such a purpose, there was then as yet no adequate provision for the training of the foresters that will be required for carrying out planting operations on any very extensive scale.

It is only fair to say that Government has carried out the more pressing of the Committee's recommendations with regard to collegiate courses, and also to providing instruction for forest apprentices, while the purpose of a great 'demonstration forest' is well fulfilled by the Forest of Dean, the largest compact block of forest and woodland in the United Kingdom, which has been placed under the operation of a regular working-plan since 1897, and has been in charge of a highly-trained and most capable superintending forester, Mr. E. P. Popert.

But meanwhile public attention has been drawn to the necessity for timber-planting, and from

various quarters pressure has been recently brought to bear so strongly on Government that the question of Afforestation is now acknowledged to be of great importance, and is receiving proper attention from the Treasury and the other Departments concerned.

During the last five years the most practical steps towards formulating proposals for Afforestation and Timber-planting on a truly national scale have been taken in Ireland. In connection with the great Land Purchase Act of 1903, certain preliminary inquiries were made concerning the extent to which waste lands might probably be plantable with a reasonable prospect of direct profit, and the late Mr. C. S. Parnell's estate of Avondale (co. Wicklow) was acquired in 1903 for the establishment there of a Forestry School for the training of forest apprentices and practical foresters. This was followed in 1907 by the appointment of a Committee by the Department of Agriculture in Ireland to consider and advise regarding an extensive scheme of operations. In April 1908 its report was issued, recommending the acquisition of sufficient land to provide for the formation of 200,000 acres or

more of State forests in large blocks, and about 500,000 acres of smaller areas under County Councils or in private ownership. It now depends on the Treasury whether this scheme shall be carried out or not.

So far as Great Britain is concerned, action has neither been so prompt nor so practical. From all sides of the House of Commons questions have repeatedly been put in order to try and ascertain the views of Government regarding the matter. Early in 1907 the powerful Association of Municipal Corporations passed a resolution 'That this Council expresses its opinion that the time has now arrived when the question of Afforestation should be seriously considered by the Government, and that it be referred to the Law Committee to take steps for urging upon the Government the necessity for initiating Afforestation Schemes.' Under this pressure an Afforestation Conference was held at Westminster on 25th June 1907, which was presided over by the President of the Board of Agriculture, supported by the President of the Local Government Board. The outcome of this was the enlargement of the Royal Commission on

Coast Erosion in April 1908 by the addition of several members to assist in the consideration of Afforestation by the State or by State aid. And as the Prime Minister has desired the submission of this part of the report by October 1908, it will very shortly be known what recommendations are being submitted for the consideration of Government.

It seems extremely improbable that the true seriousness of the timber and wood question is really understood by the British nation generally. Both the volume and the value of our imports of wood, and of pulp or paper made from wood, have increased greatly during the last twenty years, and hardly any of these are exported in any considerable quantity. Indeed, the latest statistics concerning such imports may perhaps astonish a good many people. They are as follows, for the last two years:—

Abstract from 'Annual Statement of the Trade of the United Kingdom for 1906 and 1907

IMPORTS OF WOOD AND TIMBER, WOOD-PULP, AND MANUFACTURED WOOD-PULP

ARTICLE	GENERAL DESCRIPTION	PARTICULAR DESCRIPTION	1906		1907	
			QUANTITY	VALUE	QUANTITY	VALUE
Wood and Timber	Hewn		loads	£	loads	£
		Pitwood and Pit-props	2,451,669	2,713,005	2,627,209	3,049,484
		Fir (other than Pitwood)	483,473	1,347,529	561,812	1,495,278
		Oak	172,636	1,069,804	219,850	1,386,006
		Teak	61,789	958,202	55,217	877,230
		Unenumerated	77,164	322,703	48,132	181,422
			3,246,731	6,411,243	3,512,220	6,989,420
	Sawn		loads	£	loads	£
		Fir	6,495,047	17,704,114	5,828,387	16,307,871
		Unenumerated	197,213	830,844	183,201	838,952
			6,692,260	18,534,958	5,985,588	17,146,823
	Staves		loads	£	loads	£
		Of all dimensions	139,041	632,568	171,721	736,422
	Furniture Woods (Hardwoods and Veneers)		tons	£	tons	£
		Mahogany	84,048	722,835	104,112	893,288
		Unenumerated	195,176	1,205,806	199,953	1,327,101
			279,224	1,928,641	304,065	2,220,389

				£		£
	Manufactures of Wood	Furniture and Cabinet Ware . .	...	612,502	...	565,429
		House Frames, Fittings, and Joiners' Work	...	272,949	...	224,596
		Other Sorts (including Wood Ware and Wood Turnery) . . .	...	1,131,277	...	1,130,691
			...	2,016,728	...	1,920,716
		Total of Wood and Timber . .	...	29,524,138	...	29,013,770
			tons	£	tons	£
Wood-Pulp	For Papermaking	Dry Chemical Pulp	240,649	2,055,828	270,941	2,308,748
		Wet ,, ,, ...	16,370	66,241	22,314	88,108
		Dry Mechanical Pulp . . .	6,669	28,765	6,069	29,474
		Wet ,, ,, . . .	343,123	764,375	373,175	886,017
		Total of Wood-Pulp for Paper-making	606,811	2,915,209	672,499	3,312,347
			cwts.	£	cwts.	£
Manufactured Wood-Pulp	Board Paper (mostly of Wood-Pulp)	Wood-Pulp Board, Strawboard and Millboard	3,354,958	1,128,080	3,287,773	1,134,650
		Unprinted Paper (on reels) . .	2,063,327	1,225,540	1,696,281	1,018,629
		,, ,, (not on reels) . .	3,482,483	2,771,309	3,663,444	2,899,315
		Total of Manufactured Wood-Pulp .	8,900,768	5,124,929	8,647,498	5,052,594
Gross Total Imports of Wood and Timber, Wood-Pulp, and Manufactured Wood-Pulp				£ 37,564,276	...	£ 37,378,711

It will be seen from the above that in 1907 our imports of rough hewn pitwood alone came to 2,627,209 loads, valued at £3,049,484, while those of wood-pulp came to 672,499 tons, valued at £3,312,347, these two items alone amounting to £6,361,831, and exceeding in value the similar imports of any previous year. To supply these demands, without making any provision for future increase with increasing population, would need the annual fall from about 3,000,000 acres of conifer and other woodlands—that is to say, an annual cut of about 60,000 acres of woods worked with a fifty years' rotation, or of 50,000 acres of woods worked on a sixty years' rotation. The satisfaction of the demands for pitwood I hold to be the most important matter connected with Afforestation in the United Kingdom. It can simply be a question of time before the large pitwood imports from Bordeaux to Cardiff and elsewhere must fall off, owing to the increasing demand for and the decreasing supplies of suitable wood for the French collieries. In coming years the supply of pitwood to British coal-mines must therefore cost more; and whatever tends thus to raise the price of working coal must at the same

time influence all our industries dependent on coal as part of their raw material for producing commercial articles. The wood-pulp industry is one capable of enormous expansion, given sufficient supplies of soft wood; and it is an industry that would spring up in Britain wherever such raw material could be supplied in large enough quantities. It thus differs from the pitwood question, for even now fairly large supplies of wood that might well be used in coal-mines have little or no value *in situ* owing to the cost of transport to the mining districts. As Lord Northcliffe said at the last annual meeting of the Amalgamated Press Company on the 13th December 1907, the vast population of the United States dominate the paper market of the world, and the recent large rise in the price of paper is chiefly due to the growing shortage in the supply of spruce, from which printing-paper is mostly made. In 1904 mechanical wood-pulp cost in Britain 85s. a ton; now it is 120s. In America its price has been trebled in the last ten years, and everywhere its value is bound to increase greatly in the near future.

If our waste lands and poor pastures are at all

plantable with profit, it will be in coniferous and softwood crops for pitwood and pulp that the best returns must be sought. Such crops are the most likely to thrive on poor land, cost least to establish, and give the quickest returns. And I think it may be safely taken that 3,000,000 acres of woodlands (chiefly conifer) are the minimum that should be provided by the State, either on its own responsibility or in co-operation with County Councils and private landowners. The recommendations made in April 1908 for Ireland by the Irish Forestry Committee are already known; and similar National Committees should be appointed to make the special recommendations required for England, Scotland, and Wales. But a first step towards sound practical proposals ought surely to consist in well-organised work regarding the collection of local data, county by county, relative to the amount of plantable land probably obtainable on reasonable terms. This ought, perhaps, to be most easily achieved by the co-operation of County Councils, local landowners, and the Board of Agriculture, or the Scottish Secretary's Office—or whatever Government Department is to manage the business con-

nected with Afforestation. And perhaps the very first thing to do is to settle what Department shall have this work entrusted to it. At present the Local Government Board, the Board of Trade, the Board of Agriculture, the Scottish Secretary's Department, the Scottish Board of Education, and the Office of Woods and Forests all seem to have a finger in the pie, although it is impossible that harmony can prevail and work can be efficient and prompt where so many Government Departments have to be consulted—unless these various interests, often conflicting, and sometimes jealous of each other, can be incorporated into a separate Board of Forestry, with a reasonable amount of freedom in passing definite orders on the matters entrusted to its charge. This will be all the more necessary, as it is certain that many legislative amendments will be required in the Acts of Parliament relating to the Board of Agriculture, County Councils, Income Tax, Rating and Valuation, Finance, Succession and Estate Duty, Settled Estates, Lands Improvement, Land Acquisition, Railway Fires, and other matters affecting land, crops, and finance. So far, however, as Government expenditure on actual Afforestation has

taken place within recent years the position was thus described in the House of Commons on February 11th, 1908, when Mr. Pease, a junior Lord of the Treasury, stated that—

> The amount spent by the Commissioners of Woods during the last ten years in England and Wales on Afforestation, by which term is meant planting new areas not previously under timber, as distinguished from replanting in old woods, is about £5000. The cost of land in England and Wales bought during the same period for Afforestation is about £1200. There has been no expenditure on planting new areas in Scotland or Ireland, but £25,000 has recently been spent in buying land in Scotland for Afforestation. The Commissioners of Woods receive about £30,000 annually in the shape of quit-rents on land in Ireland.

This quit-rent revenue is what the Irish party desire to see allotted to Afforestation in Ireland. But, of course, Government will have to open the purse-strings of its Treasury to a very much greater extent before any great planting scheme can be undertaken throughout the United Kingdom.

A certain amount of timber-planting has recently been undertaken by Municipal Corporations such as those of Liverpool, Manchester, Glasgow, and Edinburgh within the catchment areas for their water-supplies; while among private efforts

the Reafforestation Association has commenced work on a small scale by planting disused colliery mounds in the Black Country, and in time the total area planted will probably amount to a considerable area. Through the generous gift of the Ardgoil estate, on Loch Long, by Mr. Cameron Corbett, M.P., the Glasgow Corporation has been provided with land for gradually carrying out a comprehensive and systematic scheme of planting for the benefit of the city. But these Municipal and private efforts cannot possibly amount to such a total extent of woodlands as is necessary for our national welfare.

If the example of foreign countries can teach us anything, our nation and our Government should carefully consider the manner in which France and Germany, already well-wooded, are using every endeavour and freely allotting funds to acquire and plant waste lands. Thus, in Prussia alone, during the three years from 1st October 1904 to 30th September 1907, no less than 46,346 acres of waste lands were acquired for State Afforestation, and 33,998 acres were planted at an average cost of about £2, 8s. an acre, while grants-in-aid were also given to Com-

munes, Corporations, and Associations for timber-planting.

Much has been heard, both in and out of Parliament, of Afforestation as a means of helping to solve the sad and serious problem of unemployment. It seems hardly reasonable to expect that planting work on wind-swept waste lands in autumn and spring can be the best way of temporarily employing the elderly, the weakly, and the least skilful and energetic, who are the first to be thrown out of work in our large cities and industrial centres. The first results of any experiments of this sort will probably be such a rapid increase in the death-rate as may shock the whole nation. The planting of Welsh hills by the starving workmen from Birmingham, London, Manchester, and Liverpool, or of the glens of Argyllshire by the unemployed of Glasgow, is absolutely out of the question; and in the face of the unanimous opinion expressed by the Irish Forestry Committee it was quite unnecessary to remit this point again to the Royal Commission on Coast Erosion and Afforestation.

Certainly, however, any extensive planting

must indirectly help to ameliorate the conditions of the working classes throughout the United Kingdom. The formation, tending, and harvesting of timber crops will increase the amount of employment given to the rural population; while the preparation, transport, conversion, and distribution of woodland produce, and of all articles made therefrom, must needs add directly to the total amount of wages paid to labourers and workmen in this country—in place of being sent to foreign countries, as is the case at present.

As one example of this, and that only on a very small scale, I would instance what the Postmaster-General said at Edinburgh in January 1908, when he pointed out that the Postal Department has to import its fifty to sixty thousand telegraph poles annually from abroad; but he omitted to mention that until quite recently home-grown poles were expressly excluded from acceptance under the Government contracts.

When British oak was necessary for the navy and for shipbuilding, the timber question was for over two hundred years, by tacit consent, placed above the sphere of party politics. To those who have studied the matter, our outlook for timber is

in other respects as serious now as ever the question of shipbuilding was, and it is only to be hoped that all political parties will unite in securing for the consideration of an adequate National Scheme of Afforestation and Timber-planting that full consideration which it undoubtedly deserves.

JOHN NISBET

August 20, 1908

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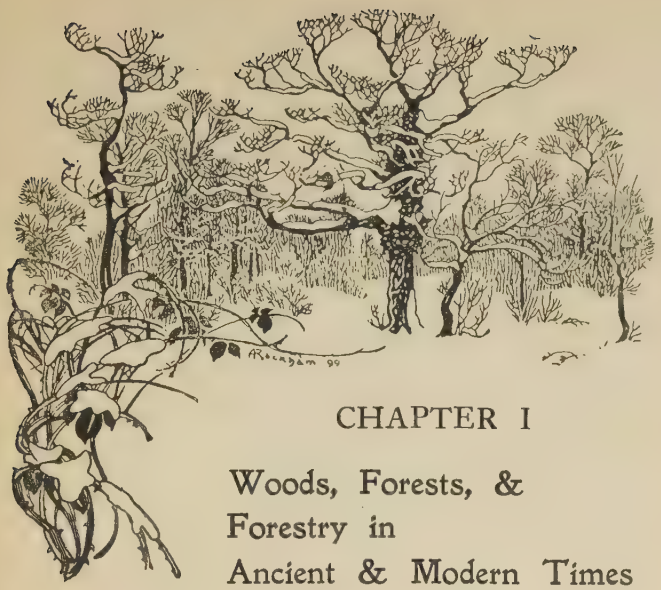
OUR FORESTS AND WOODLANDS



CHAPTER I

Woods, Forests, & Forestry in Ancient & Modern Times

ONE has only to search back far enough in order to arrive at a time when the greater portion of the globe still bore its natural covering of primeval forest in some shape or another. Except where the growth of trees was physically impossible, either through the intense rigour of arctic cold or the extreme aridity of tropical and subtropical deserts, the early dawn of man's dominion over all the beasts of the earth must have found the habitable portion of the earth's surface clad with tree-forest, varying in its

specific nature according to local climatic conditions. Amid the marvellous luxuriance and vegetative energy of tropical forests some woods, almost evergreen in their wealth of foliage, are to be found consisting of three tiers of trees or shrubs, varying from about 20 to 40 up to nearly 250 feet in height, while others, consisting of characteristically deciduous trees, have an underwood of lofty bamboos, which throw up, within their annual growing period of about five months, huge culms sometimes attaining a height of over 100 feet. Within the temperate zones both the variety of trees and the luxuriance of their growth become very noticeably less. Towards the polar regions, and at the higher elevations of lofty mountain ranges, the natural covering of forest consists mainly of Pines and Firs, Birches, Maple, and similar hardy kinds of trees. Even there, these all become of a dwarfish and slow-growing habit, in marked contrast with their dimensions and rate of growth under more favourable conditions as to climate. In every conceivable respect the vegetation and the habit of growth found towards the polar limits of tree-forest form the very antithesis of what obtains in the

hot, moist tracts densely covered with evergreen tropical jungle. These two types form, indeed, extremes which never meet.

Before man could acquire his dominion over the beasts of the field, he had of course first of all to make his fields by clearance of the natural forests. And this is a process which we still can see in practical working in various parts of the world. The Canadian backwoodsman and the Australian squatter are doing in temperate regions much the same as the hill-tribes of thickly-wooded parts of India and Burma, in clearing away 'the forest primeval' for agricultural or pastural occupation. It was ever thus, probably from long before the days when the Psalmist sang that 'a man was famous according as he had lifted up axes upon the thick trees'; and it was thus also in England, no doubt, long before the historic epoch.

During the early days of the historic period, when Caractacus and Boadicea vainly tried to resist the legions of Rome, Britain was densely wooded. Cæsar, in his Commentaries, describes the ancient Britons as a true forest people, whose military tactics consisted in retreating hastily to

the depths of the woods after delivering an unsuccessful attack, and in hampering his line of march by blocking the rough tracks with felled trees. The villages, or 'towns' as both Cæsar and Strabo called them, were merely clusters of houses grouped together for mutual assistance and defence within large clearances made in the forest. They were protected by ramp and ditch, as well as by a stout fence formed by interweaving branches of thorny trees and shrubs, and strengthened with stakes.

It is curious and interesting to note conditions as to tactics and village defence obtaining throughout Upper Burma, not long since, almost exactly similar to those which prevailed in Britain about nineteen centuries ago.

At that time the British woods consisted of Beech, Oak, Scots Pine, Birch, Ash, Scots Elm, Mountain Ash, Sallow, Aspen, Alder, and Yew, together with smaller trees and shrubs like Hawthorn, Juniper, Holly, and Gorse. To the Romans we owe the English Elm, Lime, Chestnut, Plane, Poplar, Walnut, and many other trees of the garden and the orchard, which have never become thoroughly naturalised throughout our woodlands.

Somewhat later, during the Saxon and Danish periods, Britain was not only still thickly tree-clad, but the then scanty population was mainly dependent on the woodlands for many kinds of food. Little attention was at that time paid to the enclosure or improvement of land. The woods abounded with game; and the chase, enjoyed in common, formed one of the chief means of subsistence.

When husbandry began to receive some little care and attention under later Saxon rule, lands were gradually enclosed and improved for better cultivation; while the wild animals of the woods, destructive to tillage crops, were driven away from such enclosures and confined, so far as possible, within the depths of the woodlands. As these recesses of the wilder tracts had never been taken into account in the early clearance of woodland for cultivation, they gradually became something like sanctuaries for the wild beasts; and, naturally, a gradual evolution took place from that condition to absolute reservation for the profit and amusement of the great thanes and earls, and finally for the recreation of the sovereign himself. But every freeholder still

had the right of the chase upon his own land, though forbidden to follow it into or upon the king's woods. Both traditional customs and the reputed laws of Canute, as well as the customs in the time of Edward the Confessor, give evidence that such was the case, and in all probability these ancient customs were based upon older Scandinavian practices and laws.

From the original folk-land held in common the royal demesnes and forests of England seem to have gradually sprung up as the king became more fully representative of his nation. The process of formation of '*King's Land*' and '*King's Wood*' before Domesday is somewhat obscure. But it seems clear that 'king's woods' were considered to be a special royal possession, in which the higher chase was reserved for the king, while the lower could be enjoyed by the holder of the land.

Thus, in England, the royal appropriation of large tracts of land, and especially of woodlands, as hunting-grounds, seems to have taken place as early as the period of the Heptarchy. The commencement was made when each petty local thane or princeling formed his demesne; and

when kings were at last elected and one ultimately obtained the sovereignty, he found himself the overlord of many forests scattered throughout different parts of England.

There is a sort of general popular opinion that the introduction of game laws into Britain only took place with the advent of the Normans, but this is probably due to the fact that the cruel 'forest' laws were only introduced under Norman rule. King Ine's laws are said to date back as far as A.D. 690, but the first reputed regular Statute relating to woodlands in England is the Norman forgery known as the *Charta Canuti*, or Charter of Canute the Dane, said to have been granted at a Parliament held at Winchester in A.D. 1018.

Lord Coke's suspicions as to the authenticity of Canute's Statute have been shown by Stubbs and Liebermann to be well founded. It seems to have been a forgery intended to make the harsh and cruel Norman laws seem less of an innovation than they really were. There was, however, this great difference, that previous to the Norman Conquest in 1066 what were now termed *forestæ* or forests had never been governed by such

savage laws as became the case soon after this latter date. Under the Saxons and Danes only untenanted tracts were reserved, and the penalties for hunting offences were mild in comparison with the savage punishments under the despotic 'Forest Laws' introduced by the Normans.

Lovell's *Law Dictionary*, 1727 (2nd edit., '*Forest*') enumerates sixty-eight forests in England as existing at the time of the overthrow of the Saxon kingdom, but St. John shows them, in his work on Land Revenue, to have been more numerous. No doubt in early Saxon times the whole country was more or less covered with woodlands, broken into here and there by cultivated lands; and most of the woods in the later Saxon and the Danish periods seem to have been usually of comparatively small size. The Domesday Book gives interesting details of such old woods as the New Forest in Hampshire, Windsor in Berkshire, Whichwood or Hucheuuode in Oxfordshire, Wimborne or Winburne in Dorset, Gravelinges in Wiltshire, and the Dean in Gloucestershire, still the chief wood in England. But the ex-

tensive Middlesex forest, Waltham, Hainault, and Epping forests in Essex, Rockingham, Whittlewood, and Salcey in Northamptonshire, Sherwood in Nottinghamshire, Ashdown in Sussex, Andreds Weald in Kent, and many more throughout southern, central, and northern England have long since disappeared, or exist now only in name. Some poor remains of those which did not become stringently protected royal forests are still to be found here and there, but many of them have long ceased to form large compact masses of woodland.[1]

A change in the laws or customs affecting the royal woods was a necessary measure in connection with the introduction of the strict Norman feudal system into England. William the Conqueror had not only to reward his supporters in various ways, but he had also to reduce the Saxons to subordinate position and to restrain them, as absolutely as possible, from the use of arms; and nothing could well have been more effective in this direction than prohibiting them from enjoying the pleasures and profits of the chase. As a matter of policy,

[1] See Victoria County Histories (articles Domesday and Forestry).

as well as of inclination, he confined the right of hunting to himself and to those of his great feudatories upon whom he was gracious enough, or politic enough, to bestow it. Thus, while under the Saxon kings there had been two chases, the higher being reserved for the king, and the lower enjoyed by the landholder, the Normans at once seized and kept to themselves all the pursuit of game.

In Anglo-Saxon times the chief use of the woodlands, except for hunting, fuel, and wood for building, was for the pannage of pigs. Large herds of swine were driven into the woods to fatten on the mast of the beech-tree and the acorns of the oak-groves. Before the end of the seventh century (King Ine's laws, A.D. 690) the value of a tree was estimated by the number of swine that could find shelter under it, and penalties were imposed on the burning of trees lest the woods should be destroyed by fire. Under Canute's supposititious laws the fine for destroying a holly-tree, or other tree whose fruit the beasts ate, was twenty shillings, besides other forfeiture, and even the cutting of brushwood within the royal forests was forbidden. In

Domesday Book land is often described as being a 'wood of so many pigs.'

At the time of the Conquest the ancient woodlands regarded as 'royal hunting grounds' (*silva regis*) appear to have been under the administration of four thanes or *Thegend* in each province, while other four *Lesthegend* or thanes of lower rank ranged the forests in charge of 'vert and venison,' the woodlands and the animals of the chase. Under each of these again were two woodmen or foresters of lower rank called *Tinemen*, who performed the more servile work of watchers and keepers. All of these officials were mounted and armed. The thanes administered justice and disciplined their subordinates, but were answerable only to the king, much in the same way as the Commissioners of Woods and Forests are now responsible to Parliament. Deer, wild cattle, hares, and rabbits were enclosed, but all men were allowed to shoot wild boars, wolves, and foxes outside the enclosures. Villeins and burghers were liable for the service of enclosure and stalling the big game, and for this purpose every two villeins had to keep a dog.

One of the first steps taken by William I. after the Conquest was to reserve to the crown all the old folk-land remaining unenclosed, and the crown lands were further increased by the confiscation of the property of those who had fought unsuccessfully, under King Harold, against the Normans at the battle of Hastings.

The new doctrine was also at the same time introduced, that hunting was a pastime of kings, and that the right of pursuing and taking beasts of chase and venery, and all other animals accounted as game, belonged only to the king, or to such alone as were authorised by him to exercise a privilege in this respect. All wild animals were held to be *bona vacantia* or 'owner-less property,' and therefore belonged to the king by royal prerogative. Thus, under the principles of the feudal law, the king had the right of pursuit and capture anywhere, while the common law was manipulated by forgery of the supposititious charter of Canute in such a way as to convey a sole and exclusive right in them to the king and to persons authorised by him.

This usurpation of presumed royal rights under English common law and the introduction of

feudal principles were exercised with ruthless rigour and cruel harshness. Not only did the ancient royal woodlands become jealously-preserved crown forests, but large tracts of land were also placed under ban and reserved as royal hunting grounds, within which, under colour of Forest Law, horrible tyranny and oppression were exercised upon the Saxon villeins forming the rural population.

One of the most famous of the ancient forests was in Hampshire, near the borders of what had originally been known as the Ytene forest (*Ychene*, *Eithin*, 'furze'). Between the time of Edward the Confessor (1042–1066) and the survey for Domesday Book at least 17,000 acres were afforested, and in making the New Forest William I. afforested manors, large portions of which were already forest. Local names ending in *ham*, *ton*, and *tune* are the sole remaining traces distinguishing the sites of what were once Saxon manors or villages.

William the Conqueror's action in 'afforesting' the New Forest in 1079 was certainly just about as ruthless as could well have been, but the highly-coloured versions of it recorded by

monkish historians cannot be accepted as trustworthy.[1] The wholesale destruction of thirty-six parish churches, or more, together with the houses and possessions of so many townships, to make them habitations for wild beasts, seems a gross exaggeration, although the afforestation was assuredly carried out without any particular regard to the feelings of the local population. The almost barren condition of many portions of the poor, sandy soil make it extremely improbable that this part of Hampshire could ever have been a thickly-populated and richly-cultivated tract; and this actual physical evidence must be weighed against the accusations of the monkish records. Naturally, the abbots and monks were not favourably inclined to the Norman conquerors, who drove them forth from their churches and monasteries. Hence a true, dispassionate, unprejudiced account of the royal proceedings could not be expected from them; for they were men at heart, though monks in habit.

Many of the wooded tracts in that part of Hampshire had previously been appropriated by

[1] See Victoria County History of 'Hampshire Forestry.'

the crown in the earlier feudal times, and were still in its possession; and when the reserved area was enlarged and formed into one great compact block, it was given the name of the New Forest. It was not entirely new afforestation over a large portion of a county where no royal forests had previously existed. These conditions being borne in mind, one must doubt the evidence of Walter Mapes, chaplain to Henry II., when he wrote that the 'Conqueror took away much land from God and men, and converted it to the use of wild beasts, and the sport of his dogs; for which he demolished thirty-six churches, and exterminated the inhabitants.' He merely reproduced in the vulgar tongue what Henry of Huntingdon had written shortly before in Latin; then, by the time that Joannes Brompton wrote his Chronicles in the reign of Edward III., the monkish version had become an article of firm belief. It is not difficult to picture the state of affairs which then existed. Resolved to seize and to hold all rights of the chase as a royal monopoly and prerogative, William I. still felt reluctant to drive the recently-conquered Saxon race to the

extremest verge of anger and to the hatred born of despair; so he caused the supposititious Forest Laws of Canute to be forged, and merely seemed to enforce them somewhat more strictly than had yet been the case since they were said to have been passed in Parliament in A.D. 1018. He therefore, as a matter of wise policy, passed nothing frankly in the shape of a new Forest Act during his reign; and this policy was followed by his immediate successor, William Rufus. The first genuine code of Forest Laws was the *Assize of Woodstock* (1184), in Henry II.'s reign, which established Forest Courts and Justices in Eyre, and made the Forest Law entirely independent of the Common Law obtaining elsewhere.

Under the earliest Norman laws the penalty for killing a stag or 'royal beast' within the bounds of a royal forest were almost as great as those exacted for destroying the life of a human being. It cost a freeman his freedom, an unfree man his liberty, and a bondman his life. Even to chase a stag so as to cause it to pant and be out of breath meant loss of liberty to a freeman for one year, and to an

unfree man for two years, while a bondman was outlawed, and became what was then called 'a friendless man.' The only sort of royal clemency, afterwards practically ignored, was that section in which Canute is made to say, 'I will that every freeman may take his own vert, or venison, or hunting, that he can get upon his own ground, or in his own fields, being out of my chase; and let all men refrain from my venery in every place where I will have the same.'

So insupportable became these cruel hardships under the Forest Laws, that even the Norman barons, as well as those Englishmen who still retained some of their ancestral lands, became zealous for their relaxation and amendment. Whereas William I. punished offences against them with mutilation, instead of by the fine formerly imposed, William II. increased the areas reserved as royal forests, and exacted the death penalty, sometimes even against Norman barons of high rank, though united to him by ties of blood. So oppressively were the laws administered and exceeded during the reign of William Rufus, that his detestable tyranny lived long in the remembrance of the people, while the circum-

stances of his tragic death in the New Forest were deemed the special punishment of Heaven.

So much so was this the case that his son and successor, Henry I., relaxed these Norman Forest Laws, and disafforested certain tracts in order to ingratiate himself with the people. One of his acts of this sort was to confirm by charter an ancient privilege of the citizens of London with regard to coursing in Middlesex, Surrey, and Wiltshire. Later on, however, Henry showed the same tendency to severity, and the same desire to keep to himself the right of hunting throughout the kingdom as his father and grandfather had done. He added large tracts to the royal afforestations previously made by these sovereigns. Accordingly, when his nephew, Stephen, came to the throne, he was likewise in his turn full of concessions, and anxious to conciliate the barons and the people at large. At his first great Council he granted a charter promising disafforestation of all tracts afforested by Henry, but he failed to keep this promise, and even seized again the forests made by William II. which Henry had given up.

During the unsettled times of Henry and

Stephen many encroachments and trespasses were made in the king's forests, but from the accession of Henry II., the first of the Plantagenet line, the Forest Laws and their administration occupied an important and clearly-defined position side by side with the common law. Special justices were appointed to accompany the circuits of the 'Justices in Eyre,' of whom more will shortly be said. After the Council of Clarendon a general visitation of the whole country was made by two justices in 1166. In 1175 Henry made a personal visitation of his forests in Nottinghamshire, and even exacted large fines for the destruction of vert and venison which he had himself authorised during the then recent time of war. He was in evil temper about his forests, and just before this shameless demand he hanged four knights at Lichfield who had slain one of his foresters, no doubt after much oppression and provocation.

If Richard Cœur-de-Lion had not spent most of his reign in crusading, history would probably have had much to say about a recrudescence of savagery in the administration of the Forest Laws. He loved the chase, and revived the older laws, though in a somewhat relaxed form,

but he had the merit of ordering the punishment of forest offences by fine only, in place of such barbarous mutilations as loss of eyes and cutting off of hands and feet. Even the clergy, untouched by the Common Law, were made subject to Forest Law, and the foresters were ordered not to hesitate in laying hands on them if found trespassing. Except for fuel no man could cut anything in his own woods forming part of a forest, and even trees for fuel had to be cut in view of the forester. When King John, ten years later, came to the throne, however, evil days again darkened the land and embittered the lives of the nobles and the people. His reckless procedure amounted almost to insanity. He afforested the whole of Essex except one 'Hundred,' while all Cornwall, one of the least wooded counties, was also put under the Forest Laws. Indeed this was one, and not the least, of the acts of misgovernment which banded the nobles together for the protection of their own interests and the championship of the rights of the people, and resulted in the granting of Magna Charta in 1215, the great charter of the rights and liberties of English subjects. In this,

for the first time, the most oppressive and cruel of the Forest Laws were practically repealed.

At the accession of Henry III., in 1216, forest legislation seems to have occupied a prominent place in the attention of the landed proprietors. The old ruse of William the Conquerer in forging the laws of Canute was apparently again tried in the so-called laws of Edward the Confessor, purporting to protect public as well as royal rights. A great genuine Forest Charter, however, was issued in the boy king's name by the regent, the Earl of Pembroke, in November 1217. Under this, as under the later charter of 1225, all lands afforested by Richard I. or Henry I. were declared to be disafforested, except the demesne woods of the crown; while the afforestations made by Henry II. were to be annulled where they could be shown to be to the damage of the owners of the woods. Provisions were also made that no person's life or limb should in future be forfeited for taking of the king's deer, but that a fine should merely be exacted, failing payment of which the offender should be imprisoned for a year and a day. Then he was to find sureties for future good behaviour,

and in default of this he was to be banished from England.

Any spiritual or lay lord was, when passing through a forest, free to take two beasts in view of the forester, or had to sound a horn, if no forester were present, to show that theft was not being committed. It removed some of the most flagrant abuses under which the people had suffered so heavily throughout the whole of the hundred and fifty years of Norman rule. Since the early days of Henry II. the forest administration had occupied a definite and important position side by side with the common law. This charter was to the forest administration very much what Magna Charta was to the constitution at large. In both cases rights were defined and liberties assured, thus making the future happier and more secure than the past had been.

In the following year (1218) a perambulation or *Pourallee* of the royal forests was made to determine once and for ever their true extent and boundaries; and the lands thus disafforested were classed as *Purlieu*. These were 'clear places' or tracts adjoining the forest, and once forming part of it, which were bounded by immovable marks

noted on the record of the perambulation. In that same year an ordinance was made restricting the king from making any grants of woodland in perpetuity till he came of age in 1227. When he did come of age, it may be remarked, as illustrative of royal procedure in those early days, that this ordinance was put forward as invalidating all previous grants unless renewed on payment. Then again the barons had to make a firm stand against the tendency to encroachment shown by the king, who had once more afforested lands that had been disafforested by perambulation, and had also made warrens in tracts disafforested by charter.

The most famous and valuable charter of liberty in this respect was, however, the celebrated *Charta de Foresta* of 1225, granted in the ninth year of the reign of Henry III., when he was still only eighteen years of age and under regency; and perhaps the most important portion of it was contained in the opening words of the tenth section, 'No man from henceforth shall lose neither Life nor Member for killing our Deer.'

From the time when William I. caused the so-called laws of Canute to be forged down to the Forest Charter of 1217, the kings had claimed

the right of forming a royal forest wherever they liked. 'What I wish, I will have,' was the law in practice. The king merely issued a commission under his great seal, setting forth that his royal pleasure was to make a forest in any given locality, and ordering a perambulation of the same to be carried out. This perambulation being returned, certified, and recorded, a writ was issued to the local sheriff, ordering proclamation throughout the county that the land in question had been afforested, and that no one might henceforth hunt there. Until forest officers were appointed by the king, however, the tract remained only a Chase (*Chaceus*), or sanctuary for beasts of venery and other wild animals. As such the right of hunting there could be conferred on subjects, whereas it was only a Forest (*Foresta*) when retained by the king for his own use and recreation. A Forest differed from a Chase in the three matters of having particular laws, certain officers, and particular courts for executing these laws; a Chase was usually smaller than a Forest. A Park (*Parcus*) was also a place of sanctuary for wild beasts of all descriptions, but it differed from a Chase in being enclosed, while it was usually

smaller in extent. If left open in place of being kept properly enclosed, it was liable to seizure by the king as a free chase. Hence, when such tracts or portions of chases were granted to subjects, license to impark was given at the same time. There seems to be no record as to the place where, or date when, the first park was formed; but Domesday Book mentions sixteen subjects who then held parks. From the time of Edward I. onwards most great men had parks and chases, while licenses to impark are frequently recorded in the Patent Rolls. Portions of royal forests could be granted to subjects by letters-patent, but only the king could hold a forest, as he alone could appoint a 'Chief Justice in Eyre,' an officer essential to the definition of the land as *Forest*. When portions of forest were thus granted, all the officers remained except the Justice in Eyre. In ancient law books the Chief Justices in Eyre were called *Justiciarii Itinerantes*, or judges holding a sort of roving commission, the English name being derived from the old French *Erre*, or *Ir*, 'to go.' This high functionary can be traced back to the time of Henry II. It was considered an office of such great trust and

dignity, and of such high honour and authority, that it was always filled by a peer of the realm, who was also a Privy Councillor. Originally there were three such justices for different parts of the kingdom, who had to make tours through their several provinces, as they had no power to delegate their duties to deputies; but at a later date deputies were allowed by an Act of Henry VIII. (1540).

Beneath a park in degree came the Warren (*Warrenus*), a franchise or place privileged either by royal grant or by prescription 'for beasts and fowls of warren only' or small game. Offences committed in chases, parks, and warrens were punishable under common law, while the Forest Law applied, from Henry III.'s time, only to the royal forests.

The forests or royal hunting grounds consisted of '*Vert and Venison*.' The former comprised the highwood, the underwood, and the turf; while the latter included the beasts of the forest, chase, and warren. The beasts of the forest were the hart, hind, and hare; those of the chase were the buck, doe, and fox; while those of the warren were the hare, rabbit, pheasant, and partridge.

As the greater included the less, the forest was a sanctuary for the beasts of the warren, the park, and the chase. Later on, when they began to get scarce, wild boar and wolf were also permitted to find a sanctuary within the royal forests.

Under the Norman kings the Forest Courts appear to have been held irregularly by the thanes in charge of the forests, but in the Charter of 1217 provision was made for a *Court of Attachment* or '*Woodmote*' being held every forty days for inquiry into alleged injuries to vert or venison. To this forty days' court the foresters brought their attachments before the verderers for enrolment. Offenders caught in the act of stealing vert or killing venison could be attached by the body, otherwise only attachment by their goods was permissible. It was simply a Court of Inquest. It had no power to convict or to proceed to judgment, but could merely enroll the cases and commit them to the higher court, the '*Swainmote*.' The *Swainmote* was a Court of Freeholders of the forest. The '*Swains*' or representative freeholders consisted of four men and a reeve selected from every town and village within the forest. To the *Swainmote* all freeholders owed

suit and service as jurymen, while the verderers were the proper judges, assisted by the steward of the forest.

Like the *Woodmote*, the *Swainmote* was originally held at irregular times by the chief wardens and foresters, who oppressed the people greatly by compelling their attendance or exacting fees for non-attendance. But the Forest Charter also regulated the jurisdiction and assembly of the *Swainmote* by directing it to be held only three times in the year on specific dates. Here offences of all sorts, committed by whomsoever within the limits of the forest, and not merely offences against vert and venison, were to be presented and tried by the jury, consisting of *Swains* or freeholders; and here also was presented the record of the mastiffs which remained 'unexpeditated' in the forest. The jurisdiction of the *Swainmote* consisted in receiving and enrolling the 'presentments' submitted from the Court of Attachment, in inquiring into the same, and also into charges of oppression brought against the officers of the forest. At first it appears to have been a sort of higher Court of Inquest, preparing the cases for adjudication by the *Justice Seat* or highest

forest court. Later on, from the time of Edward I., power and authority were given to convict and fine, provided that such conviction was afterwards certified, under the seals of the jury, to the *Justice Seat* or Court of the Chief Justice in Eyre, since, not being a court of record, it could not of itself proceed to direct judgment. And hence, too, execution of any judgment had to be stayed till the conviction was approved and ratified by the Chief Justice in Eyre.

The charter also directed that one of the three annual courts of *Swainmote* should be kept fifteen days before the feast of St. John or midsummer, so that the verderers, foresters, and agistors might make provision for the deer during the fawning time or *Fence Month* (*Tempus Vetitum*), when every man was forbidden to wander up and down in the forest or otherwise disturb the wild beasts.

Before the forest charter all men within the county, no matter what their degree, were bound to appear at the *Justice Seat* upon a general summons being issued; but that vexatious trouble was afterwards remedied by this great court being held only once every third year under the presi-

dency of the Chief Justice in Eyre, assisted by some person learned in the laws of the forest. Here the rolls of offences submitted by the Courts of *Attachment* and of *Swainmote*, sealed by the verderers, were presented to the Chief Justice in Eyre, as the lower courts could not give judgment or assess any fines. The jury empanelled before the *Justice Seat* consisted of eighteen, twenty, or twenty-four men chosen from among the freeholders and others present. Here, too, all manner of offences were adjudicated on, from offences against vert and venison, or extortions by the forest officers, down to misbehaviour and abusive words. One Sir Charles Howard was even fined a hundred pounds, and was committed until he paid them, for saying that proceedings had been carried against him with a high hand in respect of certain trees he had felled, and that he would have the matter heard in another place.

Forty days' notice had to be given before the *Justice Seat* was held in every third year. Being a Court of Record, it could adjudge both fine and imprisonment. If any grave matter were affected by a dubious point in forest law, the

Justice in Eyre could refer the business to the Court of King's Bench at Westminster, and his proceedings could only be removed, or any miscarriage of justice rectified and redressed, by writ of error into the same high court.

Here also, at the *Justice Seat*, such inhabitants of the forest as had attained the age of twelve years had to take their oath of allegiance in the following ancient rhyme :—

"You shall true Liege-man be,
Unto the King's Majestie :
Unto the Beasts of the Forest you shall no hurt do,
Nor to anything that doth belong thereto :
The Offences of others you shall not conceal,
But, to the utmost of your Power, you shall them reveal
Unto the Officers of the Forest,
Or to them who may see them redrest :
All these things you shall see done,
So help you God at his Holy Doom."

That about the end of the fourteenth century a good knowledge of woodcraft and forestry was general throughout the rural population in England is an inference that can be fairly drawn from Chaucer's description, in the prologue to the 'Canterbury Tales,' of the close-cropped, brown-

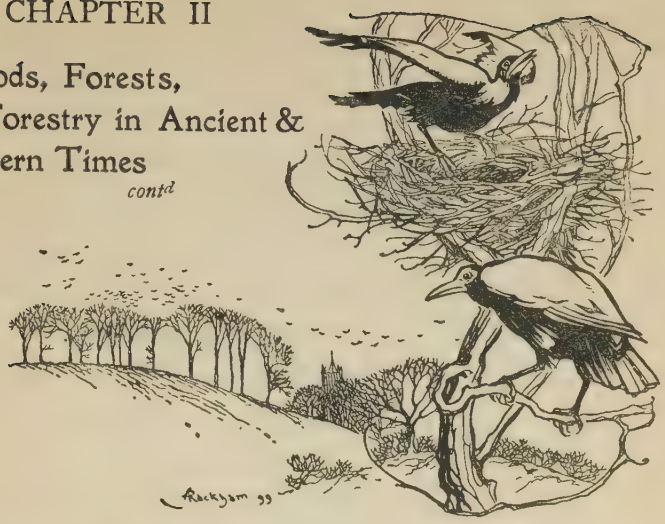
visaged Yeoman in attendance on the young Squire; for of this typical personage we are told that—

> "Of woode-craft wel cowde he al the usage.
>
> . . . . . .
>
> An horn he bar, the bawdrick was of grene;
> A forster was he sothly, as I gesse."

CHAPTER II

Woods, Forests, & Forestry in Ancient & Modern Times

cont^d



THE *Charta de Foresta*, passed in 1225 in supersession of the Assize of Woodstock and of the statute issued eight years before by the Regent, William Marschall, Earl of Pembroke, which gave confirmation of the great charters of liberty wrung from King John, forms, like these, one of the most famous charters in English history.

In addition to the leading provisions, which have already been sketched, it regulated the holding of the Swainmote; it prescribed, with due limitations, the duties and powers of certain officers of the forest, and it defined how action should lie with regard to the offences of *Pur-*

presture, *Waste*, and *Assart*. *Purprestre*, from the old French *Pourpris*, 'a taking for oneself, and enclosing,' was trespass or wrongful encroachment by enclosure or usage. Anything in the shape of building, enclosure, or exercising any liberty or privilege without special warrant to do so was, as Manwood, the great historian of old English forest laws, says, a grave offence, for 'the Law indendeth a very grievous Fine should be set on him who makes a *Purprestre* on the king's lands.' A man might not even build a dwelling-house for himself on his own free land within the forest unless he had previously obtained the requisite special license. *Waste* included everything done in the forest which tended to damage or destroy the coverts and pastures for the deer and other game. A freeholder within the forest could not even cut down any thick covert, or fell trees in his own woods, without either obtaining a license from the Chief Justice in Eyre, or else performing the act in view of the king's forester. Even ploughing a meadow without previous permission was 'waste'; and he who committed waste was fined by the Chief Justice, the place wasted being seized for

the use of the king till the fine was paid. *Assart*, from *Assartir*, or *Essarter*, 'to grub up, make plain,' was the offence of destroying any covert by rooting it up and making it plain ground. If any dweller within the forest dared to clear his own freehold land of trees and shrubs for agricultural or pastural purposes he was guilty of *Assart* of the forest, and could be fined and committed to prison till the fine had been paid to the king. Thus a *Waste* merely damaged the woods and coverts, while an *Assart* and a *Purprestre* actually destroyed portions of them, and these were therefore considered the more grievous offences. Even barons of high degree had to give heed to the position into which they sometimes drifted on account of waste. In the Pipe Rolls whole counties were placed in default for forest offences. Once on the eve of a triennial *Regard* or survey of the royal forests the Earl of Leicester procured, by special writ of the king, exemption from the fines to which he might be found liable for *Waste;* and when his record was read in public at the court 'all were amazed and astonished, saying, "Does not this earl weaken our liberty?"'

The chief local officers of the forests were the *Verderers*, *Stewards*, *Foresters*, *Regarders*, *Agistors*, and *Woodwards*. The *Verderers* (*Viridarii*) were the judicial officers of the forest, sworn to keep the assizes and laws, and to receive and enrol presentments and attachments regarding all manner of trespass or of offence against vert and venison. They were Judges of Record in the Swainmote, hearing the complaints of the Foresters, and keeping the rolls of matters to come before the Justice in Eyre; and they had also to decide in each case whether the accused should be released at large (*mainprise*), or only on bail till the day of trial. The *Verderers* were expected to be men learned in the forest law, but they were provided with a more learned *Steward* or technical adviser to assist them in coming to proper decisions as to bailable and non-bailable offences. There were usually four *Verderers* for each forest, chosen from among the esquires and men of good estate.

The *Foresters* (*Forestarii*) were the officers sworn to preserve the vert and venison within the forest, who were appointed either by letters-patent, or else by paying to the king a fee-farm rent for their office, which looks very

suggestive of there having been many illegal pickings to be made indirectly out of the appointment. But, apart from that, it was an office of high degree, usually held by great noblemen. Some held office for life, others only during the royal pleasure. Their duties were to preserve and watch over the vert and venison, and to attach offenders and present them before the forest courts. They could give no license to any one to hunt or hawk, nor could they, except under lawful warrant, themselves kill a deer in the forest without risking forfeiture of office. Every forester was bound to appear at the Justice Seat, and when he was called he had to present his horn upon his knees to the Justice in Eyre, who handed it on to the marshal, and a fee of 6s. 8d. had to be paid before the horn was returned to its owner. A woman might be a forester, the husband acting for her as forester-in-fee. If he found any man in the forest with greyhound or bow and arrows intending to hunt, the forester could arrest and imprison him, and he might pursue him within view out of the forest. It was doubtless profitable to give any one encountered in the forest the benefit of the doubt; for, before the *Charta*

de Foresta, there was a general complaint that the foresters oppressed and extorted money from the people, not only directly, but also by appointing an unnecessary number of walkers and under-keepers, who, receiving no payment, lived only by extortion. Freeholders and those exercising rights of common had hay, corn, lambs, pigs, and the like, as well as money, wrung from them clandestinely, and this was a serious aggravation of forest laws savage and brutal enough in themselves. Extortion of this sort had subsequently to be prohibited by statute, as also the custom of illicit *Scotale*, or extortion '*colore Officii*,' by keeping of an ale-house or the sale of drink by any officer of the forest, where men were induced to go and spend their money in order to avert the displeasure of the official. The *Swainmote* was charged to inquire into cases of unlawful *Scotale*, and to punish and dismiss from office any forester found guilty of this offence. Although prohibited from such extortion 'by colour of his office,' yet he was entitled to various benefits or lawful *Scotale* 'by virtue of office'; for he had the right of making collections by tenure, grant, and prescription. Thus he received five shillings

or one sheep or lamb every year from each landholder in the forest, and a certain quantity of oats or corn from each one renting land. He could also claim a subsistence allowance of three-halfpence a day, and was entitled to all the windfall and dead wood, to the browse-wood felled in winter for feeding the deer, and to the shoulders and skin of all deer killed in his beat.

The Regarders (*Regardatores*) were appointed during the reign of Henry II. to take the place of the *Lesthegend* or thanes of lesser degree in ancient times charged with the care of vert and venison previous to the Norman Conquest. The older office having apparently fallen into desuetude, the woods got into bad condition, and the number of deer became greatly diminished; so *Regarders* were appointed to keep the foresters up to their work, and to improve matters generally by 'seeing to' the preservation of vert and venison. At first the office was only conferred on knights, though subsequently it could be filled by any good and lawful man named thereto by the king. There were twelve of them for each forest. If any of these fell sick or died, the number had at once to be made up to twelve,

otherwise there could not be any *Regard* made in the forest. Like a jury at common law, they had all twelve to be unanimous in certifying their verdict or 'presentment,' else it was invalid. *Regarders* were appointed either for life or in fee, by grant of royal letters-patent; or they might be made, during the king's pleasure, by the Justice in Eyre when a *Regard* was being held; while in case of absence of one of the twelve from a Swainmote the Justice in Eyre could make nomination *pro hâc vice*. When a *Regard* of the forest or *Visitatio memorum* was ordered once every third year by issue of the king's writ to the sheriff, it was made by Regarders accompanying the Foresters and Woodwards. They surveyed all the Wastes, Assarts, and Purprestres and entered them on rolls, examined the woods, hedges, fences, and fellings, inspected mines and forges, and made inquiries regarding those who had bows, arrows, hounds, &c., for chasing and killing the deer. This roll was brought to the Court of Attachment or the Swainmote, and was afterwards presented at the next Justice Seat. They had therefore the fourfold duties of seeing, inquiring, enrolling, and certifying concerning

forest offences, and the general administration of the royal forests.

At the time a *Regard* was made particular inquiry was held into the number of dogs kept, and as to whether the owners of mastiffs had complied with the law as to 'expeditation' or mutilation of the fore-feet to prevent them chasing the deer; and they had to see this barbarous operation performed, when necessary. Every farmer and freeholder dwelling in a forest was allowed to keep a mastiff, but it had to be expeditated or lamed by maiming. This '*laming of dogs*' was more anciently called *hambling*, *hoxing*, or *hock-sinewing*, when the back sinew was cut so as to lame them in the hind-quarters; but King Henry II. introduced the system of '*expeditating*' their forefeet. The law declared that three claws of a forefoot were to be cut off by the skin; and this was done by making the poor dog set one of his fore-feet upon a block of wood a foot square and eight inches thick, setting a chisel of two inches broad upon the three claws of the foot, and striking them off at a blow. None but expeditated mastiffs and little dogs might be kept within the forest; unmaimed mastiffs, grey-

hounds, and spaniels could only be kept under warrant from the king or his Chief Justice in Eyre.

Agistors (*Agistores*) or supervisors of cattle-pasture were the four officers, appointed by royal letters-patent, who took beasts to pasture within the forest where there was any pannage. They also noted trespass done by cattle and made presentments about the same, looked after demesne woods and other lands enclosed, and received the cattle and payments of those living in the forest who had right of common on the unenclosed parts. They had to keep an account of all *Agistments*, whether of feeding cattle, &c., with herbage or with mast, and had to deliver the same to the Justice in Eyre at each Justice Seat.

The *Woodward* (*Woodwardus*) was a subordinate officer appointed at a much later date, and charged solely with looking after the woods or vert. The office of a *Woodward* and the bark of trees felled in the forest were claimed and adjudged as belonging to a manor. The *Woodward* had to appear at every Court of Attachment, and there present all offences committed

in his beat; he had also to attend each Justice Seat, and, if called, had to present his hatchet to the Justice in Eyre. If a subject had any wood in a forest and his *Woodward* neglected to appear at the Justice Seat, the wood could be seized for the king till the owner paid a fine; and it was a finable offence if the owner of woods within a royal forest appointed a *Woodward* to look after them where there had been no such office before.

During the time of Edward I. several important statutes and ordinances were passed dealing with forest law. Apparently the roll of offences in forests, chases, and warrens had grown to be very heavy, for in 1275 legislation took place against Trespassers in Parks and Ponds, and in 1278 the *Assiza et Consuetudines Forestæ* were promulgated, prescribing more clearly than previously the action to be taken and the penalties to be incurred for certain offences committed within the forests. It affirmed that 'all trees,' whether fruit-bearing or not, 'and an ash if it be old,' were vert, and therefore possessed by the king, while it was made penal to fell an oak even inside the demesne wood if within

the *Regard* of the forest. One section shows that certain persons could 'claim to have privileges, as dogs unlamed and greyhounds, within the bounds of the forest,' but the only specific authority given was that 'It is lawful for the Abbot of the borough of St. Peter to hunt, and to take hares, foxes, and martens, within the bounds of the Forest, and to have unlamed dogs, because he hath sufficient warrant thereunto.' Edward seems, however, to have been a sufficiently enlightened monarch to have learned in time that the forest laws were oppressive and vexatious both to the nobles and to the smaller landowners, as well as to the rural population generally. Hence, when these clamoured for perambulations and fixation of the true boundaries of the royal forests, Edward found it politic to accede to their request. And he was by no means loath to earn an honest penny by sale of clemency in this respect; so, in 1300, when anxious to raise money for prosecuting his war in France, he gave formal confirmation of *Magna Charta* and the great *Charta de Foresta* of 1225. In doing this he contrived to slip in a little phrase, 'without prejudice to the right

of the crown,' which was not in the original; but the innovation was soon discovered, and a fresh confirmation was demanded, to be shortly afterwards granted—under strong compulsion.

Previous to this, however, in 1293, a statute, known as that '*concerning Malefactors in Forests and Parks*,' had been issued to strengthen the hands of Foresters and of their subordinates in dealing with those found committing forest offences; so that it seems clear Edward might have been as bad as the Norman kings but for the pressure exerted upon him by the nation at large.

In consequence of delay in carrying out some disafforestations promised in 1299, the Parliament held in 1300 passed twenty 'Articles anent the Charters' (*Articuli super Cartas*), ordering infringements of them to be inquired into, and severe measures to be taken with regard to forest administration. A perambulation was accordingly held in 1301, and Edward again confirmed the charters in the Parliament held at Lincoln. In 1304, two statutes were wrung from him; but, in 1305, he obtained absolution from his oath from Pope Clement V., and used this to

evade, although he dared not formally renounce, the forest articles he had been compelled to grant since 1299.

But the people still groaned under the oppressions of the forest laws and the Foresters. Complaints were general that in place of accusations being properly made, the 'presentments' often took place at the instance of Verderers and Foresters with the design of extorting money, and that the number of officers maintained in the forests was excessive, while they lived by illegal traffic in wood and game. At length the cry which went up became so loud that it had to be satisfied by legislation, and thus was secured the *Forest Ordinance* passed in 1306. This short ordinance of six sections only was much to the point. It contained many useful regulations with regard to the proceedings at the forest courts. Trespassers were ordered to be presented to the next Swainmote; the Verderers were to be chosen by the freeholders, and appointed by the king's writ; and all offences of the forest officers, whether against the king or the people, were ordered to be presented, tried, and punished. It also removed certain grievances of the common

people suffered at the hands of the nobles. The perambulations of the forests had thrown many disafforested lands into the hands of certain barons, who gained personally; but they ground down their tenants so much, that the latter wished their lands to become part and parcel of the royal forests again, in order to secure their former rights of pasture and common; and this was secured to them, if they wished such a privilege, under the new ordinance.

There was no fresh legislation during Edward II.'s reign; but as soon as Edward III. ascended the throne, in 1327, pressure was again successfully applied in amending the still vexatious laws. The statute then passed regulated still more definitely the procedure at the Swainmote, and ordained 'that henceforth no Man shall be taken nor imprisoned for Vert or Venison, unless he be taken with the *manner*,' or *manouvre*, that is to say, as regards Vert, either in cutting or carrying it away, and as to Venison, in being taken in *Stable-stand*, *Dog-draw*, *Bloody-hand*, or *Back-bear*, as the various terms were for lying in wait for, chasing, breaking up, and carrying off the royal deer. Another statute, also passed

during that same year, said that 'Every Man that hath any Wood within the Forest, may take House-boot and Hay-boot within his said wood, without being attached for the same by any Officer of the Forest, so that he do it in View of the Foresters.'

And yet a third statute of that first year of reign ordained that if the Chief Warden of a forest, the later development of the ancient Forester, refused to bail an offender in vert or venison, a writ of Chancery could be obtained directing this; and if the warden still declined to bail him, another writ could be had directing the sheriff to apprehend the warden himself.

The legislation thus effected at the very commencement of Edward III.'s reign broke the back of the ancient forest laws. Though it did not paralyse their force, yet it was the direct cause of gradually weakening the hold of the crown on the royal forests. In the third year of his reign this king was also compelled to confirm *Magna Charta* and the *Charta de Foresta* of 1225, to guarantee that future perambulations should be as in the time of Edward I., and that a charter should be made and given to every shire peram-

bulated. Extortion and oppression by Foresters again becoming rife, a purveyors' statute was issued in 1350, ordaining that 'No Forester nor keeper of Forest or Chase, nor none other Minister, shall make or gather Sustenance, nor no other Gathering of Victuals, nor other thing, by Colour of his Office, against any Man's Will, within their Bailiwick nor without, but that which is due of ancient Right.'

Further concessions were demanded from Richard II., but the next legislation only took place during the last year of the reign of Edward IV. (1482), authorising the cutting and sale of woods, and their enclosure for a term of seven years, 'with sufficient Hedges able to keep out all manner of Beasts and other Cattle out of the same Ground for the Preservation of their young Spring.' In this Statute, for the first time in the history of England, it is recognised that a subject may own a forest.[1] Hitherto a forest had been a royal monopoly; and perhaps the insertion of

[1] The statute begins thus: 'If any of the King's subjects, having Woods of his own, growing on his own Ground, within any Forest, Chase, or Purlieu of the same within this realm of England, shall cut, or cause to be cut, the same Wood or part thereof, by Licence of the King or his Heirs, in his Forests,

the word 'forest' may have been a casual error in place of a purposeful innovation.

Thenceforth, for sixty years nothing in the way of forest legislation was enacted by Parliament. Henry VII. made it a felony to hunt deer at night in the forests with painted visors, and Henry VIII. made it also felonious to enter a forest with intent to steal deer, though this last rule was soon repealed by Edward VI. But in 1543 came Henry VIII.'s great *Statute of Woods*, (see page 54). The last royal forest created in England was Hampton Court, afforested by Act of Parliament in the thirty-first year of Henry VIII.'s reign. The two statutes enacted by Henry in the year following that concerned themselves with the 'Drift of Forests,' or driving of horses and other beasts of the field to ascertain that the forests were not burdened to a surcharge by those holding rights of common, and with enabling the Justices in Eyre to appoint a deputy to make their circuit or *Iter*. Such circuits were regularly made down to 1635, when they ceased.

Chases, or Purlieus, or without Licence, in the Forest, Chase, or Purlieu of any other Person, or make any Sale of the same Wood : It shall be lawful to the same Subject,' &c.

After the Restoration, Charles II. tried to renew them, in form at any rate, but the only *Iter* seems to have been that made by Vere, Earl of Oxford, in 1670.

The effect of Edward IV.'s statute of 1482 seems to have been to give a great impulse to the wastage and destruction of woodlands, and to the clearance of wooded tracts for agricultural and pastural purposes. That this was so seems clear from what is said in Holinshed's *Description of England* (1577): 'I might here take occasion,' is said in the chapter *Of Woods and Marishes*, 'to speake of the great sales yeirlie made of wood, whereby an infinit quantitie hath bin destroied within these few yeers: but I give over to travell in this behalfe. Howbeit thus much I dare affirme, that if woods go so fast to decaie in the next hundred yeere of Grace, as they have done and are like to doo in this, sometimes for increase of sheepwalks, and some maintenance of prodigalitie and pompe . . . it is to be feared that the fennie bote, broome, turffe, gall, heath, firze, brakes, whinnes, ling, dies, hassacks, flags, straw, sedge, reed, rush, and also seacole will be good merchandize even in the citie of London, where-

unto some of them even now have gotten readie passage, and taken up their innes in the greatest merchants parlours. . . . Certes very small occasion in my time is enough to cut down a great wood, and everie trifle sufficeth to laie infinite acres of corne ground into pasture.'

How strange now seems this early reference to '*seacole*,' as then apparently only beginning to supplant the use of wood as fuel! By Evelyn's time its use in London had become so general, that in his treatise *Fumifugium* (1661) he wished the London smoke nuisance to be rectified by immediate Act of the Parliament then sitting. As a matter of fact, coal became an article of trade under Henry III., while in Scotland the first charter giving the right to dig for coal dates from 1291. But it did not become a common article of fuel till a very much later and comparatively recent date.

Henry VIII.'s *Statute of Woods* (1543) ordered 'replantation of forest trees to cure the spoils and devastations that have been made in the woods,' while in Scotland the planting of woods was also encouraged about the same time, in the reign of James V. (1513–1542). It had

previously been decreed by James II. that 'woods sould be planted, hedges made, and brome sawing, under sic paines, as law and unlaw of the Baron or Lord sall modifie.' In 1504, during the reign of James IV., it was enacted that, as 'the wood of Scotland was utterly destroyed,' a penalty of five pounds should be incurred for felling or burning green wood in future without permission; and every lord and landholder was obliged to plant at least one acre of wood, if there were no great wood or forest upon his estate. The larger landowners were also required to form parks replenished with deer, and to make ponds, rabbit-warrens, dovecots, orchards, and hedges. These penalties proving insufficient, the fine was raised; for James V. enacted that 'planting of woods, forests, making of hedges, and hayning (*i.e.* enclosure) is commanded to be done, under the paine of ten pounds.'

This is very much to the effect of what the Holinshed Chronicles subsequently desired for England. 'I would wish,' they said, 'that I might live no longer than to see some things in this land reformed, that is, . . . that everie man, in whatsoever part of the champaine soile enjoieth fortie

acres of land, and upwards, after that rate, either by free deed, copie hold, or fee farme, might plant one acre of wood, or sowe the same with oak mast, hasell, beech, and sufficient provision be made that it may be cherished and kept. But I feare me that I should then live too long, and so long that I should either be wearie of the world, or the world of me; and yet they are not such things but they may easilie be brought to passe.'

Even earlier than this, however, trees and woods had been cultivated prior to the reign of Edward IV., and in 1534 Master Fitzherbert issued '*The Booke of Husbandrie*,' the first work in the English language which deals with the cultivation of trees. In this he treats shortly of the removal and planting of trees, the felling of timber and of wood for household use or sale, the '*shredding*' or pollarding of trees, and coppicing in enclosures, or how '*to kepe springe wode*.' Immediately after the chapter on trees comes a quaintly naïve passage in which '*short informacyon for a yonge gentylman that entendeth to thryve*' is thus given: 'I advyse hym to get a copy of this present booke and to rede it frome the begynnynge to the endynge, whereby he may perceyve

the chapytres and contentes in the same, and by reason of ofte redynge he may waxe perfyte what sholde be done at all seasons. For I lerned two verses at grāmer scole, and those be these:—

> "*Gutta cavat lapidem non vi, sed sepe cadendo:*
> *Sic homo sit sapiens non vi, sed sepe legendó.*"'

How many schoolboys since then have had to learn the same old story, that the constant dropping of water weareth away a stone, and that a man may acquire much knowledge by constant reading?

The course of affairs with regard to the great woodlands of Scotland, Ireland, and Wales cannot be traced with anything like the same precision as in England, nor are they probably anything like so interesting, According to Skene (*Celtic Scotland*, vol. iii. p. 283), 'what had originally been the waste land of the tribe became known as the forest, and became dissociated from the cultivated land of the thanage. It either formed the subject of a separate grant, or was retained as a royal forest.'

These royal forests comprised large tracts of land subject to the '*Forest Laws*,' which were nothing like so severe as those that had been

enforced in England. Large tracts in the south covered with a natural growth of trees were devastated during the period when Edward I. waged war in Scotland; and John of Gaunt, Duke of Lancaster, is said to have employed twenty-four thousand men in destroying the forests as punishment for an incursion. Before the Stuarts ascended the throne of England, Jacobean statutes had been promulgated throughout Scotland enjoining the formation of plantations of trees; and early in his reign James I. of England gave attention to the preservation of immature timber trees, and issued, more than once, proclamations enjoining the retention of 'stores' when the underwoods were being felled. In a proclamation, issued in 1608, he notified that 'great spoils and devastations are committed with our forests, parks, and chases.' And, the royal edict set forth, 'we therefore have endeavoured to take course to stop the said abuses . . . to the end that our care may appear to the preservation and increase of timber as well to others as to ourselves . . . we do straightly command and charge all our loving subjects in general that in their own woods they presume

not hereafter to defraud the true meaning of our statutes by cutting and felling the young stores when they usually fell their underwoods.' And he set an excellent example by laying down a rule for the New Forest, that in the ordinary annual falls for fuel, &c., 'all timber trees are to be excepted, and all saplings of Oak that are likely to make timber, and that twelve standels be left in every acre.'

Much the same thing probably happened in Ireland, though neither that country nor Scotland has yet had its Manwood to trace and record in detail the gradual evolution of the forest laws. Harbouring the Irish, the woods were a source of danger to the English nobles, and everything was done to effect their destruction; while from the very circumstances of English rule in Ireland there could be no royal forests reserved for the king's amusement.

That the Scottish laws relating to forests were nothing like so ancient as those of England seems clear. 'There is, probably, no Scotch writing extant,' says the Preface to the *Acts of the Parliaments of Scotland*, published by royal command in 1844, 'whether of Charter, Record, or Chronicle,

so old as the reign of Malcolm Canmore, who died in the year 1093. And there is no good reason to believe that writing was practised at a much earlier period in the country. The scanty notices of partially-informed foreigners, or the still more fallacious native traditions, are therefore our only guides to the civil history of the earlier period.' And with regard to 'laws for which no authority exists so old as the reign of Robert I.' (1306–1329), it remarks that 'most of the later manuscript compilations have a large collection of laws under the title of *Leges Forestarum*. But these are always of a most miscellaneous description, and contain only a few that are properly forest laws and regulations. All of that description are here given. They are for the most part chapters of well-known English statutes, and it may be thought their chief value here, to show how readily the Scotch lawyers, even of a later age, adopted the provisions of the English legislature, while nevertheless they preferred pecuniary penalties and mitigated the savage spirit of the forest laws of England.'

Sir John Skene, in his *Regiam Majestatem:*

The Auld Lawes and Constitutions of Scotland, faithfullie collected furth of the Register and other Auld authentick Bukes (1609), gives the full text of 'The Forest Laws, whereof the Author is alleaged to be King William, in ane auld Buke pertaining to S^r^ David Lindesay of Edzell, Knicht, and ane of the Senatours of the College of *Justice*.' Subsequent investigations have shown so early an authorship to be incorrect; but Skene was himself conscious of working under certain disadvantages, when he said in his preface, 'Quhat I have done, I remit it to thy judgement and censure: I have travelled meikill, ane lang time; bot how profitable, I can not declare. I am the first that ever travelled in this mater, and therefore am subject to the reprehension of many, quha sal follow after me; quhom I request maist friendlie to take in gude parte, all my doings.'

The laws themselves are, even for a much later date than King William (1165–1214), characterised by extreme leniency. They are comprised within twenty-two short sections. The herding or straying of cattle was forbidden in 'the close or hanite parts of the

wood' (*silva prohibita*), 'except they have licence fra the Forester: be fiftene days before the feast of *Saint John the Baptist*, and be fiftene days after the said feast, under the paine and unlaw of aucht kye'; and a similar fine was payable on the third occasion on which cattle had been allowed to enter the king's forest, the mulct on each of the two previous times being 'foure pennies.' If sheep were found grazing in the forest, 'quhither there be ane keiper or nocht, the forester may tak ane scheip to his awne use of the flock'; while 'gif goat be found in the forest thrise: it is lesome to the forester for ilk time, to hang ane of them be the hornes, upon ane tree. And for the fourt time, to slay ane of them.' Again, 'anent swine, it is ane approuen use and consuetude, to defend and forbid publickly in paroch kirkes, that they enter nocht within the Forests. And gif they be found within the Forest be the Forester after the said inhibition, it is lesom to him, for ilk time of three times, to tak ane to himself. And gif they be found the fourt time, they sall be all taken, and imbrocht to the King's use.' Pannage was, how-

ever, provided for in good mast years. 'Gif it happens that there be great abundance of akecornes within the King's Forest, the Forester sall summon the Burgesses and Landwartmen; that they bring their Swine: to the effect, that the King may have his pannage for them. And this is the forme and maner of the pannage: for ilk *cyndire*, that is, for ilk ten swine, the King shall have the best swine: and the Forester ane hog. And gif there be fewer than ten, the King sall have na thing, bot the Forester sall have ane hog, and for ilk auld swine, gif anie be, ane pennie.' In like manner, if horses were, after inhibition, found in the forest, the forester could take a yearling, a two-year-old, and a three-year-old for the first three offences; but, when found for the fourth time, 'all the stude salbe taken to the King's use.'

Men were treated in a lenient and reasonable manner. 'Gif any stranger be found within anie forbiddin place of the forest, and wil sweir upon his wapons, that he knew nocht that way, to have been forbiddin; and that he knew nocht the richt way: the forester sall convoy him to he common way, and there sall suffer him to

passe away without anie trouble. But gif he be ane knawin man, he sall be taken and convoyed to the King's castell: and there without the ports of the castell the forestar sall take before witnes his upmaist claith; and all quhilk is in his purse sall pertaine to the forestar: and his bodie sall be delivered to the Constabil, or Porter, to be keiped at the King's will.' Pledges were taken for any man 'quha may be attached for grene wode,' but he could only be arrested as 'ane taker, or stealer of grene wode' after the third such attachment. Immediate arrest was only made on the third offence 'gif the forestar finds anie man without the principall wode, but yit within the pale or closure, heueand dune ane aik trie without the advise or deliberation of the forestar, or wiridier.' Felling of trees and cutting of grass within the forest itself was, however, a more serious offence. 'Gif anie man cuts greene wood within the forest: he sall pay an unlaw of aucht kye. Gif anie man uses to cute, or scheir grasse, or anie other thing in the forest: for ilk time of three times, he sall give aucht kye; and for the fourt time ten ponds.' The owner of

a 'mastiche hound or dog' was answerable and liable to be put under pledges if it were 'found in anie forest; and he be nocht bound in bands,' while 'gif ane hairhound be found rinnand, to the hurt of the forest; he sould be taken, and presented to the forestar, or viridier: quha sall send him to the King, or to the cheif Justiciar of the Forest.' Offences against game were, as under English law, considered the most serious; yet even they were, by comparison with the Southern laws, very mildly dealt with. 'Gif anie man takes ane wilde beast in the forest, without ane warrant,' he was to be arrested, and could not be set at liberty 'without speciall command of the King, or of his Justiciars'; while 'gif anie hunts within the King's forest, without licence; he sall pay ten ponds.' Successful hunting was therefore a much more heinous offence than the mere pursuit of the chase. A free tenant who had 'be vertew of his infestment, free power to hunt within his awne land, marchand neare to the King's forest . . . may follow his hounds within the King's forest, as farre as he may cast his horne or his dog-leisch.' Otherwise, 'he sall pay

aucht kye: and sall tine his hounds, with the beast.'

These ancient Forest Laws of Scotland seem, indeed, to have been conceived in the finest and most generous spirit of true sport. Nothing could well be more reasonable than the last clause of the section relative to hunting within the king's forest. 'And quhasoever sall follow his hounds or dogges runnand at ane beast, fra his proper land within the King's forest: he sall remove, and lay aside his bow and his arrowes, gif he anie hes; or he may bind the bow and the arrowes with the bow-string. And gif the hound slayes the beast: he with his hound and the beast sall pas away quite and free, but anie challange of the King, or Lord of that forest.'

In one point the Scottish laws differed essentially from the English, because forests could be owned by 'anie Baron: being infeft by the King, in free Forest: and with inhibition that na man do anie trespass in the samine; under the forefault, and pane of ten punds.' The laws applied equally to these as to the king's forests, but such 'Lord of the Forest' could

condone no crime or trespass. 'Gif the Lord of the Forest will not persew the said crime, or trespass: or yit dissembles for particular affection, that he knawes anie sic crime or trespass: Nevertheles, the King hes gude richt, and titill to aske ten punds; for breaking of his command, and inhibition foresaid.'

The Jacobean laws as to hunting, hawking, and so forth were all likewise drawn up in the true spirit of genuine sportsmanship. 'Na man suld ride or gang in their neighbours cornes in halking, or hunting, fra pasche untill the samin be shorne. Na man suld ride nor gang upon quheat na time of the yeare. Na Pertrik suld be taken untill Michelmas. Na persons ranges uther mens woods, parkis within dikes, or brumes, without license of the awner of the ground, under the paine of refounding the skaith to the partie, and ten punds to the King, for the first fault: twentie punds for the second fault: and confiscation of moveable gudes for the third fault.' All offences against the game laws were 'crimes punished by pecuniall paines.' A fine of ten pounds was inflicted on any one who 'should slay Daes, Raes, nor Dear in time of storme, or

snaw, or slay any of their Kiddes, untill they be ane yeare auld.' Forty shillings was the pain for taking eggs 'out of Pertricks, or wylde Dukes nestes'; and the same penalty extended to taking partridges, plovers, black-cock, grey-hens, muir-cocks, 'nor sic fowles,' from the beginning of lent till August. Hares and Rabbits, or 'cunnings' as they were then called, were not to be slain in time of snow under penalty of six shillings and eightpence.

Rough but effective protection was also given to the larger wild birds in those days. 'Na man sall sell or buy any read of fallow Deare, Daes, Raes, Pertricks, Mure-fowles, Black-cocks, Aith-hennes, Termiganes, wild Dukes, Teiles, Ateils, Gordons, Mortons, Schildernes, Skaildraikes, Herons, Buteris, any sic kinde of fowles, commonly used to be chased with Hawks, under the paine of ane hunder pounds to be incurred, alswell be the buyer as the seller: and in case any of them be inabill to pay the said summe, they sall be scurged be the apprehender, throw the burgh or towne, quhere they are apprehended.' One poor, unfortunate bird, however, was outlawed and doomed to remorseless destruction.

'Ruikes bigand in Kirkyards, Orchards, or tries, sall be destroied, and their birds not suffered to flee away, under the paine of forfaultour of the tries, and ane unlaw of five shillings to the King.'

How remote these days were from the present is brought home by another of the laws of the same time. 'The Schirefs and Barons suld hunt the Wolf foure or thrie times in the year, betwixt *S. Marks* day and *Lambes* quhilk is the time or their quhelpes. And the tenants sall rise with them under the paine of ane wadder, of ilke man not rysand.' The last wolf heard of in Britain was the one shot by Sir Ewen Cameron of Lochiel in 1680.

What pictures of olden times and ancient customs do some of these quaint laws call up, and what contrasts to the sports and amusements of our day! 'Archarie is commanded to be used of all men, being of twelf yeares of age, under the paine of ane wedder, or of fourtie shillings. Na man sould play at the golfe, nor at the futball, under the paine of fiftie shillings. Because they are estimed to be unprofitable sports for the common gude of the Realme, and defence thereof.' Golf and Football forbidden! And

in Scotland, too, of all places! How strongly this reminds one of the old Latin quotation, long since worn threadbare, as to how 'times are changed, and we have changed with them.'

Looking back to the time of James I., when the British Isles were but thinly peopled and little cultivated, a rough idea can easily be formed of the vastly greater extent of country then under woodlands than is now the case. Most of the Scottish hills north of the Forth and Clyde still bore their natural covering of pine, which also clothed large tracts here and there southwards to the Yorkshire moors. All over the chalk hills, from beyond the Cotswolds eastwards along the Chiltern Hills and the ranges forming the backbone of Gloucestershire, Hants, and Bucks, the remnants of the beechwoods give indication of the fine growth with which the limy soil must once have been densely covered. It is to the oak forests, however, which once clothed great tracts of loamy and clayey soil on the uplands and in the valleys of all central and southern England, and the milder valley tracts from the Humber and Mersey northwards to the pine tracts of the Scottish highlands, that Britain

in part owes her present exalted position among the great nations of the earth.

Recent suggestions that many of our waste lands and our barren moors might now advantageously be planted up have been met by some with the objection that it would be vain to clothe wild tracts with forest where no trees are growing. This idea rests on a total misconception of past historical facts. Waste lands were originally under wood, and *waste* meant the felling or cutting down of any woods which grow scattering, or any thick covert in the forest, without the license of the Forest Court. Chalmers, in his *Caledonia*, 1807 (vol. i. page 791), tells how 'every district of Caledonia, as the name implies, was anciently covered with woods. The many mosses of Scotland were once so many woods; as we may learn from the number of trees, which are constantly dug from the forests, that have lain for ages below the surface. During the twelfth and thirteenth centuries not only the kings, but the bishops, the barons, and abbots had their forests in every district of North Britain, in which they reared infinite herds of cattle, horses, and swine. It will scarcely be

credited that many bleak moors, which now disfigure the face of the country, were formerly clothed with woods, that furnished useful timber and excellent pasturage; yet is the fact clearly proved by the positive evidence of record. Oak appears, in those times, to have been the wood of most general use. The bridges, the castles, the churches, and the towns were chiefly built with this useful timber. The waste of domestic use, as well as the wars of Edward I., left many woods of great magnitude, and usefulness, in every shire of Scotland, at the accession of Robert Bruce. Still more wasteful wars commenced with that event, which may be said to have lasted, with little intermission, during half a century. Add to the devastation of these wars the destruction of time and chance, of neglect and idleness, whence we may clearly perceive adequate causes of the deplorable waste of the Scottish woods. There are in the maps of Scotland a thousand names of places, which are derived from the woods, which no longer exist on the face of the country. And there are in the Chartularies numerous notices of forests, in many places where not a tree is now to be seen.'

What remains, for example, of Ettrick Forest in Selkirkshire, consisting largely of pine mixed with oak, birch, and hazel, where 'beasts of chase, and birds of prey, formerly abounded'? Clearance and change have been made even since the comparatively recent days of the song of the *Outlaw Murray*, when it could be said that—

> 'Ettrick forest is a fair forest,
> In it grows many a semelie trie;
> The hart, the hynd, the doe, the roe,
> And of a' beastes great plentie.'

With the accession of the Stuart dynasty to the English throne the work of clearance of woodlands for agricultural and pastural purposes, already in rapid action since the statute of 1482, went on apace with increasing energy. While commanding his 'loving subjects' to store oak standels when felling their timber, James I. also greatly encouraged the clearance of woods for utilisation as arable land, and stimulated what was then considered progress in a rather laudable work. In Ireland especially, his 'plantations' or colonising schemes were certainly the direct cause of quickly reducing the area under woodland. The movement in this direction was

further stimulated by the chronic impecuniosity of Charles I., and the agricultural policy of Cromwell. Not only did Charles alienate by grant, to court favourites and for ready money, large portions of the crown forests, but he very unseasonably revived certain powers of forest law which had fallen into disuse. Both Elizabeth and James I. had alienated large portions of the crown forests by letting them on lease or in fee-farm, and Charles I. endeavoured to claim such lands again. The Earl of Holland, as Chief Justice in Eyre, held Justice Seat each year, in place of only once every three years, and suborned juries were made to find the king's title by inquisition. He even tried to re-afforest the greater part of Essex, as King John had done, and his whole action with regard to forests was about as insane as that monarch's. Charles I., in short, utilised the Forest Courts to extort money independently of the grants from his Parliament. And such was the extent of his oppressions that the great Assembly, which assumed the powers of government and condemned the king to death, passed a statute giving effect to the former laws regarding the boundaries of forests. The Act for the

Limitation of the Forests, passed in 1640, determined for ever any increase of the royal forests beyond what were their boundaries as existing in the twentieth year of James I.

This virtual repeal of the stringent forest laws and abolition of the forest courts again gave an immense impetus to clearance of woodlands. Besides large conversions into arable and pasture land, great tracts were denuded of timber and allowed to sink into the unprofitable condition of barren moorlands and waste heaths. At this same time, too, great stretches of woodland and forest in Scotland were destroyed by fire under the orders of General Monk, who commanded Cromwell's army during the Scottish invasion. Traces of such destruction are still to be found in the charred pine stems buried in many bogs and morasses that have taken the place of the ancient forests.

The woodlands rapidly diminished everywhere, either being cleared for husbandry or destroyed by fire. Even in the far north the great ancient forest of Caledonia, covering a vast tract of country throughout the central area north of the Forth and Clyde, with pine on the hills and

oak and other broad-leaved trees in the valleys and along the water-courses, became, to a great extent, destroyed and split up into comparatively small woods here and there; and these in turn have now ceased to exist save merely in name.

Many of these survivals of the great ancient woodlands fell to the axe about a century ago, when prices rose considerably for timber growing within easy reach of the then existing markets. In most cases a clean sweep was made of them, and a goose was thus killed which might now have been laying golden eggs.

The Commonwealth gave the deathblow to the oppression which the forest laws had exerted on the people of England for nearly six hundred years. Portions of the ancient royal forests still exist, as the New Forest in Hants, the Forest of Dean in Gloucestershire, and others elsewhere; but their administration was modified considerably after the Restoration, the savage claws of the forest laws being then cut almost as effectually as the mastiffs used to be 'lamed' of old. And their present administration as Crown lands by Commissioners of Woods and

Forests, Verderers, and Deputy-Surveyors, in accordance with comparatively recent Acts of Parliament, is quite a different matter from what it once was.

At the time of the Restoration the forests of Britain still supplied all the navy timber and much of the other wood required. But the supply of oak for the king's navy and for the growing mercantile fleet had run so short, that those in authority were greatly concerned about future supplies. So much so was this the case, that the necessity for doing something to encourage the growth of timber, and especially of oak, was pressed upon the king's notice. The plan resolved on was to get the then recently-founded Royal Society to select some one of light and leading to discourse upon the pleasures and profits of growing timber. The man selected for this purpose was John Evelyn, a younger son of the Squire of Wootton, in Surrey, one of those taking a chief part in the foundation of the Royal Society, the Presidentship of which he thrice subsequently refused. He had all the requisite qualifications for the task proposed. Filling various offices as a Commissioner of the

Crown, he was well known and mixed in the best society of the town, where he was also already recognised as somewhat of an authority on matters of rural economy. Besides these essential requisites, he had the additional qualification of being a most devoted and loyal courtier, distinguished by his protestations of loyalty even at a time when the general tone of the demonstration and expression of this was what would now be considered sycophantic in the extreme. Bringing a vast store of enthusiasm, a graceful style, and what was in those times termed a 'pretty wit' to the genial task, Evelyn on 15th October 1662 read to the Royal Society his *Sylva; or, a Discourse of Forest Trees, and the Propagation of Timber in His Majestie's Dominions.* Ordered by the Society to be printed, this charming work, the great classic of British Forestry, went through no less than five editions by 1729, nine editions by 1812, and three since. In our own days of depression in the value of landed estate, of death duties, of rating of woodlands, of other burdens that have fallen heavily on land, and, lastly, of often excessive preservation of ground game, Evelyn might have been speak-

ing but yesterday when, in his preface 'to the Reader,' he says that his treatise 'is only for the Encouragement of an *Industry*, and worthy *Labour*, too much in our days neglected, as haply esteem'd a consideration of too sordid and vulgar a nature for *Noble Persons* and *Gentlemen* to busie themselves withal, and who oftner find ways to *fell* down and destroy their *Trees* and *Plantations*, then either to *repair* or *improve* them.'

As a good Royalist he gives a hard knock to the heroes of the Commonwealth, and he at the same time indicates certain of the causes of the excessive clearance of woodlands, when he continues: 'But what shall I then say of our late prodigious *Spoilers*, whose furious devastation of so many goodly *Woods* and *Forests* have left an infamy on their *Names* and *Memories* not quickly to be forgotten! I mean our unhappy *Usurpers*, and injurious *Sequestrators;* not here to mention the deplorable necessities of a Gallant and Loyal *Gentry*, who for their *Compositions* were (many of them) compell'd to add yet to this *Waste*, by an inhumane and unparallel'd *Tyranny* over them, to preserve the poor remainder of their *Fortunes*, and to find them *Bread*.'

The particular difficulty about oak timber for shipbuilding, however, became greater as time went on and the requirements of the nation increased. The tonnage of the navy, which had been 17,110 tons in 1603 and 57,463 in 1660, rose during Charles II.'s reign to 103,558 tons. And it went on steadily increasing, and had risen to 413,667 tons by the end of 1788, while the supplies of oak were, on the contrary, rapidly falling. From 197,405 loads of timber fit for the navy in the New Forest in 1608, the supply sank to 19,873 in 1707. Under more conservative treatment about Evelyn's time it rose to 36,662 loads in 1764, but by 1783 it had fallen lower than ever, to 19,827 loads, or not much more than one-tenth of what it had been less than 180 years before. (Percival Lewis, *Historical Inquiries concerning Forests and Forest Laws*, 1811, pp. 121, 226.) But just as our humid insular climate has saved us from absolute agricultural ruin, such as would have been the certain consequence of excessive clearance of woodlands if we had a climate like that of continental Europe, so too did our ocean communications and our acquisitions in the East Indies save us from what might

have been disastrous difficulties about insufficient supplies of oak for our shipbuilding yards. The pressure of the dockyards was relieved by the shipment of teakwood from Bombay; and this was the commencement of the trade in teak timber, which is now exported from Burma to the value of nearly £1,600,000 a year.

As time went on many other demands for timber for constructive purposes arose which could not be satisfied from the woods and forests left in England. Soon after the ninth edition of Evelyn's *Sylva*, the fourth edition with A. Hunter's notes, was published in 1812, a powerful article on Forestry appeared in the *Quarterly Review;* and this, along with Sir Walter Scott's celebrated advice of the Laird o' Dumbiedykes to his son Jock, stimulated many landowners to form extensive plantations. But the art of Forestry was not then known as it now is, though planting was well understood and excellently practised. Thus many of these plantations of the first quarter of last century, which have recently become or are now becoming mature and marketable, have not yielded, and cannot reasonably be expected to

yield, anything like the same monetary returns as would otherwise have been the case if due knowledge and consideration had at time of planting been brought to bear on certain important matters. I may instance selection of the best kind of trees for the soil and situation, to be grown under the conditions naturally suitable, close planting, and judicious thinning regulated mainly in accordance with the demand for light made by each kind of tree forming the ultimate crop to be harvested as mature timber. And there has very often been neglect in various matters which go to make the difference between Arboriculture, or growing of trees, and Sylviculture, or Forestry concerning itself with the growth of crops of timber.

As matters are, our woods and forests now only aggregate about three million acres, and are so inadequate for the supply of existing requirements in timber and other woodland produce, that our imports under these heads amounted to the enormous sum of over twenty-nine and a half million pounds sterling during 1906. Of this over four million pounds were for hewn fir, pitwood, and pit props, and nearly eighteen million pounds for sawn fir (see preface), conifer-

An English Mixed Wood (Belvoir)

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ous timber from the Baltic, Scandinavia, and Canada, which might quite well be grown in the British Isles. Making a liberal deduction for the value of labour included in these coniferous imports aggregating about twenty-two million pounds, the undeniable fact is laid bare that Britain annually pays, and principally to foreign countries, no less than between eighteen and nineteen million pounds sterling for pines and fir timber which could quite well be grown in Great Britain and Ireland. There are some sixteen million acres of mountain and heath land, partly suitable for planting; and if our existing woods and forests were managed on business principles, and State encouragement were given for making large plantations under economical management, Britain might in the future grow a large proportion of the coniferous wood required for building and mining.

In Britain, Forestry on business principles must soon pay better than ever it has done since the changes consequent on the great revolution in communications and commerce effected by railways and steamships. The rapid commercial development and the ever-growing expansion of

trade in America and Germany, our greatest commercial rivals, are bringing an influence to bear on the great timber markets of the world which had years ago begun to cause the price of timber to rise. And this rise in the price of timber will not be merely temporary, it must necessarily be permanent and progressive.

Briefly stated, the economic conditions now already obtaining, and practically certain soon to become greatly accentuated, are such that the present sources of supply throughout the world can hardly even meet the existing demand. But the demand seems certain to increase, and such enhancement can only be met by working out timber from backwoods and remote tracks which are at present unremunerative. Hence a general rise in prices throughout Scandinavia, Russia, and Canada must be the direct result of competition between Britain, America, and Germany. Consequently, also, prices for home-grown timber in Britain must rise; and the highest market price will, of course, be obtainable for clean, well-grown and healthy timber best answering the requirements of the market.

If our present three million acres of woodlands

were trebled in extent, and were all managed on business principles, in place of being under a casual management for game coverts and pleasure grounds, as is now mostly the case with British forests, this would not yield sufficient wood to supply our existing requirements. Nay, even if we had twelve million acres under forest, and all under the best of management, they would probably hardly do more than (if, indeed, they did as much as) supply the present demand for pitwood, other timber, wood-pulp, &c. And past experience has shown that the demands for timber are constantly increasing, despite the more extensive use of substitutes like iron and stone for constructive purposes, as population increases.

While the total imports of hewn timber have only risen in proportion to our growing population, those of sawn and dressed timber have during recent years increased far more rapidly in value; and this upward tendency is likely to manifest itself yet much more rapidly in the near future. It seems marvellous, indeed, that a matter of such great national importance has hitherto received so very little attention. If

adequate measures were taken to try and grow the twenty-two million pounds' worth of pine and fir we now import, and which imports may become greatly increased in value within a comparatively short period, a vast economic field, now left neglected and uncultivated, could easily be made to yield a golden harvest. Not only would this vast sum be retained within our own country, in place of (as now) going chiefly to foreign countries, but much more money would also be circulated in the formation, tending, and reaping of the crops of timber, in its transport and conversion, and in its distribution to the places of consumption. With so much land of poor quality lying uncultivated in many parts of the British Isles, the apathy shown towards Forestry in Britain is one of the things that it is impossible to understand. Our humid climate has saved us from the agricultural consequences of excessive clearance of woodlands; but we are now probably very soon about to reap commercially what we have sown in the wholesale destruction of the crops of timber with which the British Islands were once quite as richly endowed by nature as were the foreign

countries that have better husbanded their natural resources in woodlands.

Heroic measures to replace the woodlands destroyed can only be undertaken on a sufficiently large scale by receiving considerable encouragement and assistance from the State, whose attitude has only recently become at all sympathetic in this respect. But something, at any rate, can without much difficulty be done to remedy existing defects in the management of the Crown forests and of private woodlands in Britain; and in the following chapters an attempt will be made to indicate various matters tending in this direction, without treating them in too technical a manner.

It is, however, only right to state that something substantial has been done both by Government and by Municipal Corporations and private persons for the improvement of the lost art of British Forestry since the first edition of this book appeared in 1900. A brief statement of the chief movements in this direction, and of the present position of the United Kingdom as to imports of pitwood, timber, wood-pulp, &c., will be found in the introductory 'Preface.'

CHAPTER III

Among the Oaks

NO other tree of the forest has so often as the Oak been sung by poets. Ever since the days of Virgil and Horace it has been the monarch of the woodlands, the typical embodiment of majestic grandeur, of stately strength, and of rugged resistance alike to the wet storms of spring and autumn, and to the cold wintry blasts. Whether as an ornamental tree in parks and pasture lands, spreading out giant arms beneath which the cattle and sheep can find a welcome refuge from the burning sun in summer, or as a true tree of the forest, growing as a standard in copse or as a timber tree of the highwoods, the oak is

by common consent one of the most beautiful and poetic objects in sylvan scenery.

It would, indeed, be sacrilege to lay the axe to the roots of the aged monarchs of many a park and chase, and to fell for gain the last survivors of stately trees coeval with those which Tennyson describes so graphically in *The Foresters*, when Robin Hood, addressing Maid Marian, whom he had crowned with an oaken chaplet as Queen of the Wood, invites her to

> 'Sit here by me, where the most beaten track
> Runs through the forest, hundreds of huge oaks,
> Gnarl'd—older than the thrones of Europe—look,
> What breadth, height, strength—torrents of eddying bark!
> Some hollow-hearted from exceeding age—
> That never be thy lot or mine!—and some
> Pillaring a leaf-sky on their monstrous boles,
> Sound at the core as we.'

But in the woods themselves it is a different matter. Here a beauty of utility can often quite easily be allied closely with beauty of form, for modern Forestry on business principles is certainly not synonymous with the spoiling of sylvan scenery. The shapely stem and the well-formed crown of branches and foliage on oak standards grown properly in copse-woods are

no less lovely in their own way than the huge-limbed, rugged trees allowed to spread their arms abroad and to remain standing till long after their maturity, when their usefulness and their greatest profit as timber trees are already on the wane.

The oak has played a far more important part in English history than any other tree. Oaks were objects of worship among the aboriginal Celts and Britons; they were the sacred trees beneath whose boughs the ancient Druids performed their mystic rites. Of such an aged oak Spenser well says in his *Shepherd's Calendar*—

> 'For it had been an ancient tree,
> Sacred with many a mystery.'

It was beneath the spreading branches of oaks that the Folkmote was at one time held. They were often historical landmarks, known for centuries as fixing the boundaries of parishes and shires. At the time of the Conquest they were principally valued, like the beech, for the mast they yielded as pannage for hogs and swine, and as toothsome food for the king's deer. Later on, however, throughout the whole of the early period

of the naval development of Britain, the oak was by far the most important among timber trees. Its uses, and its national importance formerly, may be estimated from the following appreciation of it in Harrison's *Description of England* (Holinshed's Chronicles, chapter xxii.): 'Howbeit as everie soile dooth not beare all kinds of wood, so there is not anie wood, parke, hedgerow, grove, or forrest, that is not mixed with diverse, as oke, ash, hasell, hawthorne, birch, beech, hardbeame, hull, sorfe, quicken aspe, poplers, wild cherie, and such like, whereof oke hath alwaies the preheminence, as most meet for building and the navie, whereunto it is reserved. This tree bringeth foorth also a profitable kind of mast, whereby such as dwell neere unto the aforesaid places doo cherish and bring up innumerable heards of swine. In time of plentie of this mast, our red and fallow deere will not let to participat thereof with our hogs, more than our nete: yea our common pultrie also if they may come unto them. But as this abundance doth proove verie pernicious unto the first, so these egs which these latter doo bring foorth (beside blackenesse in color and

bitternesse of tast) have not seldome beene found to breed diverse diseases to such persons as have eaten of the same.'

Between 1640 and 1813 the value of oak timber increased tenfold. During the last thirty years of that period it had been quadrupled. Although no longer a necessity for shipbuilding, its uses are now so manifold and so well known, that it would be superfluous to enumerate them. In general durability it excels the timber of any other tree grown in Britain; and anything like well-grown sound timber can easily be disposed of at two shillings to half-a-crown, and often more, per cubic foot.

From the manner in which the oak has usually been grown in Britain, however, there is often a want, in fact one might say there is a chronic want, of long clean stems undamaged by branch knots. The whole of England had to be scoured to obtain suitable oak trees for lock-gates in the Manchester Ship Canal, and there is the greatest difficulty in obtaining boles that are sufficiently long and straight to form beams of large size.

This is, of course, the natural consequence of adherence to the methods which were most suit-

able for the growth of oak when it was mainly required for shipbuilding. Crooks for knees and ribs were necessary, and they could be obtained of the best quality and in the shortest space of time by growing the oak trees as hedgerow timber, or in parks, or as standard trees in copsewoods, where they were allowed to have almost perfect freedom to ramify according to their natural habit when not limited with regard to growing-space, as ordered by the Statute of Woods (1543).

The early perception that a certain limitation in the space allowed for growth is essential for securing a good long stem, thus forshadowing one of the leading principles in the modern methods of Forestry, is clearly proved in the following extract from Evelyn's *Sylva*, which at the same time indicates with equal distinctness the generally approved and customary system of growing oak so as to encourage the formation of curved wood specially adapted for naval purposes. 'Some advise,' he says, 'that in planting of *Oaks*, *&c.*, *four*, or *five* be suffer'd to stand very neer to one another, and then to leave the most *prosperous*, when they find the

rest to disturb his growth; but I conceive it were better to plant them at such *distances*, as they may least incommode one another: for *Timber-trees*, I would have none neerer then *forty* foot where they stand *closest;* especially of the spreading kind.'

This freedom and liberty of expansion sidewards in all directions has long remained one of the guiding principles in British Arboriculture, the oaks being grown as individual trees, and not regarded as merely important units or valuable items in the crops of timber. And it is only within the last few years that general opinion in this country has begun to veer round so far as to admit that better monetary results are usually obtainable from woodlands if these be grown much more thickly than hitherto, or 'in normal density of canopy for the given kind of tree,' as runs the formal phrase of the scientific forester.

Even before Evelyn's time the disadvantages of allowing branches to develop to an excessive extent had been loudly decried by William Lawson in his *New Orchard and Garden* (1618); but he advocated pruning, and not any closer

position of the oak trees, for the improvement of the bole.

It is only by growing oak, and all other trees, more closely together than has hitherto been customary in Britain than the natural habit of this fine timber tree towards branch formation, and more especially the somewhat more spreading tendency of the English or pedunculate oak as compared with the Durmast or sessile oak, can be controlled so as to direct its energy in growth towards the formation of a long clean bole, free from thick branches causing knots that would ultimately form weak spots in beams and scantlings of timber. And it is equally certain that this long and strong class of clean-grown stem now fetches the highest price in the timber market, because it yields the strongest and best wood required for technical purposes. Here, too, it may be remarked that for timber-planting the sessile oak is preferable to the pedunculate species, as it forms the finer and cleaner bole. Even more than 300 years ago it was recognised that branching growth unfitted the oak for certain purposes; and the Holinshed Chronicles speak of 'most of the

wainescot that is brought hither out of Danske, for our wainescot is not made in England.'

Following the change in the market requirements there must of course, in the case of all woods grown mainly for profit, be a corresponding change in the method of growing wood to supply these new demands. This is now being recognised in Britain, and changes will naturally take place in the treatment of woodlands. In many cases, however, improvements must occur slowly, if at all; for the praiseworthy conservative feeling which regards the woods of large landed estates as sacred ancestral heritages will naturally only yield gradually, when it is seen that the removal of old trees and their replacement by younger stems of more vigorous growth is no wanton desecration of the beauty of 'the woodlands wild.' Churlish, indeed, would be he who could wantonly, whether for his own profit or otherwise, remove the aged, storm-battered oaks still flourishing here and there in the woods or at the edges of the forest as historical records, reaching perhaps in their own life back to the ancient times when they still bore their original name of *Aik*, now surviving only casually here and there

in names of places such as 'Acton,' 'Akenham,' and the like. But, happily, by natural regeneration of oak in copses and highwoods, and by sowing acorns, the old crops of timber can be renewed without the eye being offended by the rigid regularity of lines in plantations.

Where long stems of oak were obtainable, in former times, this was usually the result of chance rather than of set purpose and design. Often, in fact, they were produced through what was then always considered as rather a neglect of thinning. But the advantage of close growing was sometimes illustrated in a very practical manner, as, for example, in the following instance mentioned by Gilbert White in his *Natural History of Selborne*, in which he describes how 'On the Blackmoor estate there is a small wood called Losels, of a few acres, that was lately furnished with a set of oaks of a peculiar growth and great value; they were tall and taper like firs, but standing near together had very small heads, only a little brush without any large limbs. About twenty years ago the bridge at the Toy, near Hampton Court, being much decayed, some trees were wanted for the

repairs that were fifty feet long without bough, and would measure twelve inches diameter at the little end. Twenty such trees did a purveyor find in this little wood, with this advantage, that many of them answered the description at sixty feet. These trees were sold for twenty pounds apiece.' Losels is now a treeless meadow.

There is, however, a limit to this forcing of the oak in restricting its strong natural tendency towards branching habit of growth, with a view to the development of a long, clean bole. With the oak, as with all the other forest trees, the manner in which this treatment may be practised depends not only upon a variety of physical conditions relating to the given soil and situation, but also upon certain specific natural requirements regarding a sufficient space for the growth of each individual tree. These special characteristics show themselves, in a very marked degree, either in a strong demand for light or in a greater or less capacity for bearing shade.

In dealing with any kind of tree grown as a timber crop, control over the tendency to the formation of large branches can only be exerted so long as the vegetative energy can be trans-

formed from impulse towards lateral extension into growth upwards. So long as a rather close condition of crop results in good growth in height, this is more advantageous than branch development; but when the former has reached its maximum and shows signs of diminishing, it is then time to thin lightly, so as to allow the remaining trees to have a better crown of foliage and to thicken in girth. Neglect to thin at the proper moment would of course lead to a crowded and unhealthy condition, which is just as much to be avoided as too open a growth. It is thus that oak forests are treated in some parts of continental Europe, where they are made to attain a maximum height of from a hundred to a hundred and thirty feet, often with a clean stem for about two-thirds of their length. The height attainable depends, however, to a very great extent on the depth and the general suitability of the soil. On deep, fresh loam and in cool, shady dingles and dells the oak is less impatient of shade or of lateral confinement than on light sandy soil or warm exposures, where its natural demands for light and air become very marked. The soil that in general suits the oak best is deep heavy

clay or a stiffish loam, though it also does well on a lighter loamy and sandy soil that is deep and fresh. But the largest trees and the finest quality of wood are produced on deep clay land. In its natural habit of growth the oak exhibits as necessitous a demand for light and air during the young pole stage of growth as any other of our hardwoods, not even excepting the ash. And this natural characteristic must always be taken into account in growing it for profit as a crop of timber.

The oak is suitable for growing in every kind of wood. It is a fairly good hedgerow tree, for it neither robs the soil of food intended for the crops, nor tends to hinder the plough by throwing out long shallow roots like ash and elm ; nor does it injure the crops by overshadowing to so great an extent as some trees. In coppice for tanning-bark it used to be a good form of investment, yielding a quick and profitable return in the days before the English market was spoiled first by cheaper foreign bark and then by still cheaper extracts and chemicals. Its resistance, both in branch and root, to the violence of storms makes it, no less than for its beauty, the tree most suitable for

parks and pasture-lands. Its value makes it one of the most desirable of the standard trees in copsewoods, where the comparatively light shade it casts on the underwood does not interfere unduly with the growth of the latter. Finally, it forms an excellent crop in highwoods, though in this form it can best be grown along with the beech, which can not only bear a greater amount of shade, but also preserves the moisture and the general quality of the soil by overshadowing it better, and by enriching it with the mould formed from its heavy fall of foliage rich in potash.

Though still possessing in many parts good value as coppice, it is rather as a timber tree of the copses and of the highwoods that the oak has now, and will in the future continue to have, its greatest value. Hence it may perhaps be profitable to give a little closer attention to these particular methods of growing crops of oak for the timber market. In the great majority of British woodlands oak is chiefly to be found in the copses. It is the principal tree among the overwood, and has always been the predominant standard from time immemorial. But the treatment there accorded to it has ever been merely a haphazard

sort of rule-of-thumb measure. Even Henry VIII.'s command (*Statute of Woods*, 1543) that 'twelve standels be left in every acre,' and that 'all saplings of oak that are likely to make timber' should be reserved when carrying out the fellings, though a great move in an economic direction, did not go far enough to ensure more or less regular supplies of timber of different sizes at each return of the fall to any given copse. This is easily explainable. As Percival Lewis remarks of the New Forest about ninety years ago, 'The rabbit, in his pursuit of food did much injury, and the cutting of browse wood' (for feeding the royal deer), 'as it was carried on in former times, must have been attended with considerable depredations; the holly and the thorn are often the preservers of the seedling oak.' The same applies to-day to a great many good oak-producing districts. In the self-sown woods of Sussex, some friendly furze brush has often been the guardian angel of many a seedling now grown into a stout and sturdy sapling or pole. The consequence is that in most of our copsewoods the standard trees are not more or less regularly distributed over the area, and there is no regular gradation in

the ages of the standard trees forming the overwood. Again, many of the oak trees, with large spreading branches, have been allowed to remain long after completing their main growth and thus attaining their marketable maturity. Yet the beautiful old oak trees that have endured from generation to generation in woods owned by the ancestors of the present landholders have a truly great and æsthetic value of their own, and for their loss mere money could never compensate. The work of destruction is ever more rapid than that of construction; and a couple of woodmen with axe and saw could, in a few hours at most, bring down with a crash to the ground the stateliest old trees in the forest.

The presence of vast numbers of large-crowned oak trees in the copses is, however, a concrete factor that must be taken into account wherever the owner may desire to apply business principles to the management of his woods. The oldest or the most interesting trees can easily be preserved, more especially if growing at the edge of the woods or at the margin or crossing-points of rides and green lanes. The others should be gradually removed during the next two or three

falls of coppice, and should be replaced by storing fresh standards of a kind more likely to suit the requirements of the timber market of to-day, and better grown from all points of view.

The oak coppices freely, and can send out good healthy stool-shoots up to the age of sixty, or even, under exceptionally favourable circumstances, ninety years of age. When the bark was still easily saleable and highly remunerative, oak was, of course, encouraged as one of the chief kinds of wood among the coppice. Owing to the fall in the price of oak-bark, however, this must naturally be less the case in future than formerly. Thus, while efforts should be made to stock the coppice as thickly as possible with hazel, ash, oak, sycamore, maple, and beech, according to the nature of the soil, the main value of the oak will probably in future be as a standard for the production of timber. The only other trees which are likely to compete with it as copse-timber are ash and larch. Often equally well paid, and even sometimes much more remunerative than the oak, these are, like it, trees making very strong demands on light and air, casting but a comparatively light shadow

over the underwood growing around them, and thriving best when the soil is well protected by a thick undergrowth of densely-foliaged coppice. As the treatment for woods of this sort can be more appropriately described with reference to all the light-demanding trees, detailed consideration of the modern continental method of working copsewoods may advantageously be left to form a subsequent chapter by itself (see chap. ix., pages 260–295).

The growth of oak in highwoods may either be pure or else in mixed crops along with other kinds of trees. Pure woods of oak can only be grown to the best advantage on a soil that is fertile, deep, and fresh. Where there is a tendency to moistness in the soil, it is better to grow it along with ash, elm, maple, and sycamore, or even with alder on land inclined to be marshy. On drier land, especially where the soil is at all limy, oak can best be grown along with beech, which protects and improves the soil, and keeps it as cool and fresh as circumstances permit.

Whether planted pure, or only in groups on the better parts forming patches throughout a

matrix of beech or other kinds of hardwood trees, the treatment of the oak is based on the ruling principle that, as it is to form the ultimate crop of timber to be harvested, it shall throughout all the operations of tending and thinning receive the chief consideration. Other species interfering with its growth are to be removed in favour of it whenever necessary, and individuals of its own species must also be cut out whenever they interfere with the continuous good development of those stems which, subject to gradual elimination of the weaker or rather inferior specimens, will in due course of time form the mature harvest of timber to be ultimately reaped.

Oak timber grown in this manner may generally be expected to attain maturity at about one hundred and fifty to two hundred years of age, although reliable data are not yet available to indicate anything like definitely what rotation of oak in highwoods will prove most remunerative. Such data are still exceedingly difficult to obtain in Britain ; and, at best, they depend so much on local circumstances—as to market demand, communications and transport, soil and situation, and the like—that it would perhaps be somewhat rash

to formulate any sort of general dictum about such a matter as the most profitable age to fell timber in highwoods. One can only generalise, and even then not always correctly, as markets themselves change in time.

All throughout the first half of this period, when the young woods are passing through the thicket and the pole stages of growth till the young trees have been drawn up to near the total height they can attain on the given soil and situation, the cleanings and weedings and thinnings of the young woods should be carried out with special reference to the oak. No definite rule can be framed as to the time when this operation becomes necessary. On some soils the poles complete their main growth in height as early as the fortieth to the sixtieth year, while in other cases this condition is not attained till perhaps the seventieth or eightieth year. Except where profitable, or when filling spaces that would otherwise be blank, all softwoods like birch, aspen, and willow should be cut out in favour of hardwoods of any kind; while the latter should be removed wherever they interfere with, and threaten to impede or altogether suppress,

the growth of the oak. Only thus can the oak, the ultimate crop desired, maintain itself in advance of the other competitors for light and air, because most of these are usually of somewhat speedier growth and therefore likely to outstrip it in the struggle upwards for supremacy. This war of genera—this 'struggle for existence' observable everywhere as one of the great laws of nature—is nowhere more clearly noticeable than among the trees of our forests and woodlands.

With the completion of its main growth in height, the time arrives when the oak requires a larger individual growing-space than it should hitherto have been permitted to enjoy. Confined within limits only prescribed by the danger of overcrowding, the oaks have been forced upwards so as to develop the greatest length of bole, and the straightest, cleanest stem which can be obtained under the given local circumstances; and the future object of the forester must then of course be to make the young trees thicken in girth as rapidly as possible, so as to get their maximum of profit as a crop of timber in the shortest space of time. The 'financial maturity'

or most profitable time of harvesting crops of timber, whether highwood, copse, or underwood, is, in fact, with regard to woodlands, very much what 'the psychological moment' is in human affairs. Hence no rigid rule can apply.

To those who are only acquainted with our British woodlands, the best-managed woods on the continent of Europe would at once appear unhealthily crowded, and consequently badly managed. But the fact admits of no argument, that woods of all descriptions must be far more closely and thickly stocked with highwood trees, standards in copse, and coppice than now obtains as the practice, if our woodlands are to be worked so as to yield the largest returns on the capital represented by the land and the crops of timber it is bearing—at any rate as regards hardwoods.

There is only one way of enabling the young trees to thicken rapidly in girth when once their main growth in height has been completed; and that is to allow them, from that time onwards, a larger space for the growth of each individual tree. But this should only be effected gradually, and it may easily be carried to excess. If cut free suddenly, so that each tree has almost an

isolated position, the effect of the freer enjoyment of light and air is often to cause a strong growth of young shoots below the crown of the tree, which then becomes 'stag-headed,' and deteriorates in value as timber. Even when the damage does not actually proceed thus far, the giving of more light and air than is necessary under the circumstances tends always to make the crown of foliage and the branch development work down the stem, so as to interfere with the ultimate value of the bole as clean timber. The young trees should therefore be gradually accustomed to a larger growing-space, so that the crown of foliage of the tree may increase and elaborate a greater quantity of sap year by year.

Thenceforth, thinnings or partial clearances of the crop are necessary about every ten to fifteen or twenty years when the expanding crowns of the oaks are found to interfere with each other. And when such operations are being carried out, the trees removed are of course those which show signs of disease, trees of other kinds, like ash or sycamore, which reach their full physical maturity at an earlier age than oak, and such oak as would prove least profitable if allowed to remain longer

on the ground for the purpose of thickening into larger and more valuable stems.

Up to this period in the cultivation of crops of oak timber, judicious thinning forms the best method of tending oak highwoods. With the exception of larch, no timber tree is so much as the oak dependent on thinning for its healthy growth and continuous development. The great golden rule for thinning, 'Begin at an early period, thin out only moderately, and repeat the operation frequently,' is one whose judicious application is essentially necessary in growing crops of oak. As a tree making strong demands for light, however, what would be a moderate thinning for beech would prove insufficient for oak. Hence, in conducting thinning operations in oakwoods, the requirements as to growing-space for the next four or five years should be anticipated and provided for, and then another examination should be made.

In thus dealing with crops or groups of oak, these somewhat anticipatory thinnings should remove all stems that are not necessary for the maintenance of the *leaf-canopy* or crown of foliage of the wood; because crowding of the

individual poles, indefiniteness with regard to what will form the predominating stems throughout the crop, and a long struggle for supremacy over surrounding competitors for the available supplies of light, are even less desirable in oakwoods than in other hardwood crops. When the trees are older, even the formation of a small blank here and there is preferable to interference with the crown of foliage of the best trees, as such blanks often soon close up again. But when thinning is neglected, or is delayed too long, or is carried out insufficiently, the further development of the oak is apt to be unsatisfactory and disappointing—and it is then too late for any remedy to be applied.

This is, however, a very different matter from the far heavier thinnings made in olden times for the express purpose of growing trees of branching habit to yield crooks for the naval dockyards and for shipbuilding in general. Though the market demand for timber has long since changed, yet the old method of thinning, now excessively heavy for the production of what must prove the most remunerative description of oak, is still adhered to. This system seems easily capable of im-

provement, and it stands in need of immediate change.

Simultaneously with heavier thinnings when the main growth in height has been attained, or with partial clearances to stimulate the rapidity of growth in girth, attention will have to be paid to protecting the soil against the deteriorating influences of wind and sun. The strong demand made by the oak for light, as evidenced by the comparative thinness of its crown of foliage, is of course accompanied by inability to shade the soil from the exhausting effects of sunshine and dry winds; while the now open condition of the canopy of foliage overhead, caused by the requirements of this tree for a large growing-space during the second half of its life-period, renders artificial assistance of some sort necessary. This (wherever profitable) can best be given by means of providing an underwood for the protection and improvement of the soil. Where the oak is grown scattered among a matrix of beech, special measures of this sort are usually unnecessary; but otherwise they are very desirable for avoiding loss of capital through deterioration of the soil, which will affect both the future rate

of growth of the present still immature crop of trees and the whole well-being of the next crop of timber that may thereafter be grown.

The best kind of underwood is beech, so far as the protection and improvement of the soil is concerned; but in most parts of Britain local conditions will usually indicate ash, hazel, and perhaps sycamore, maple, elm here and there, as more likely to be profitable; for in our humid climate these, and particularly the sycamore, will often bear so considerable an amount of shade as to make it very suitable for such an underwood. Many of these will no doubt spring from the stool when their stems are removed during the earlier thinnings; but if not, then much can be done for the formation of underwood at a cheap rate by sowing and dibbling seed on well-hoed patches, and by layering stool-shoots or seedlings found growing on the area.

When once underwood has been formed, the future treatment of the crop as it now exists must of course depend mainly on local conditions connected with the market for timber. In fact, it is almost superfluous to remark that all the arguments which can be adduced in favour of better

treatment of our woodlands are absolutely worthless unless such change will be remunerative. If woods are to be treated on business principles, then the treatment must really depend most of all on the market for timber or other wood. It is only when once a remunerative market is ensured that advantage is to be found in improved methods of Forestry. Such underwood as above can either be worked as coppice, or it can be allowed to grow up into larger poles to be harvested when it is desired to reap the crop of oak timber, as local conditions indicate.

Oak woods treated thus may usually be expected to attain their most profitable age, *i.e.* their financial maturity, at about a hundred and forty to a hundred and sixty years, when the stems should be quite as large as would be those of two hundred years of age if grown in regular highwoods as a pure crop of oak.

The regeneration of such woods and groups as above described can easily be accomplished if the soil has been properly protected. If the oak has been grown along with beech, however, it may often be best to regenerate the latter naturally in

the manner to be described in the next chapter, while the oaks for that new crop can be introduced wherever desired by means of planting stout healthy transplants. Otherwise the specific method of regeneration must of course depend on the nature of the underwood. If that be thick and likely to spring vigorously from the stool when cleared from the ground, nothing will succeed but to put out stout oak plants strong enough to hold their own, with assistance in the way of weeding and thinning, against the coppice. But if the woods have been thick enough to be nearly pure oak at last, beneath the canopy of which the underwood is not of very vigorous growth, this can be cleared away and utilised while measures are taken for natural regeneration of the oak from seed. This is not usually difficult, because where crops of oak can be grown with more profit than pine, fir, and larch, the soil must be anything but poor in quality.

Many of the self-sown oak and beech woods are now found difficult to regenerate naturally. Owing to the want of close cover the soil often gets overgrown with grass or, worse still, with moss; and then a satisfactory crop of self-sown

seedlings cannot reasonably be expected. Soil-preparation of some sort is in such cases absolutely necessary to enable acorns and mast to germinate and establish themselves in the soil. Moreover, the change in the conditions between the olden and the present times must also be taken into account. Most of the woods now mature date back to a period when cattle and swine were probably still largely driven into the oak and beech woods for grazing and pannage; and these were in the vast majority of cases, no doubt, the principal agents in obtaining a satisfactory regeneration. The sharp hoofs of the cattle, and the burrowing and wallowing of the swine after satisfying themselves with mast, worked the acorns and beech-nuts into the ground, besides breaking this up so as to loosen it, aerate it, and prepare it generally as an effective seed-bed. Indeed, in many of the continental woods, and especially in beechwoods, the herding of cattle and the pannage of swine form some of the usual steps taken at the time of a seed-felling for the regeneration of the mature crop of trees. It is cheap, and to a certain partial extent effective; and it forms a good basis for the assistance of natural

regeneration by more elaborate artifical measures in the way of hoeing or digging, sowing, and planting.

A certain amount of soil-preparation to form a seed-bed for the acorns will almost always be necessary. Unless thus enabled to come into actual contact with the soil, perhaps not one-hundredth part of the acorns ever has the very slightest chance of germinating on the dead foliage or weeds which cover the surface of the ground. The necessary soil-preparation can conveniently be made in strips or patches, and of course additional advantage is gained if the acorns are dibbled into these. Otherwise, dibbling of acorns may take place over the whole area without special preparation of seed-beds; but the early development is always best, with the oak as with all other kinds of trees, when the soil has been loosened, and thus aerated and rendered more easily penetrable by the tiny rootlets of young plants.

As soon as the seedling crop appears the seed-bearers have soon to be removed, because the young oak is impatient of even the comparatively light and broken shade cast on it

by the parent trees. This is especially the case on rather poor and dry soil, where the young seedlings cannot thrive if deprived of the dewfall at night. On a good, fresh soil, however, there is less risk of damage being done by the overshadowing of the mature crop, so that the removal of the seed-bearing trees can in this case be extended over a somewhat longer time than would otherwise be advisable.

As the parent trees are removed, the blanks thus formed may be filled either by sowing acorns or by planting ; while other blank spaces, perhaps caused by their being poorer patches of soil, or arising from any other physical reason, can also be sown or planted with beech, ash, sycamore, or whatever seems most likely to prove profitable. An excellent opportunity is also then offered for planting larch here and there, as, in admixture with such a crop, it develops into fine stems, and is much less liable to canker than when grown in a pure crop by itself. Without taking up much space or interfering perceptibly with the other trees, except the oak itself, larch stems grown thus among highwoods of broad-leaved trees yield timber of the best

quality, and commanding the highest price. Larch there finds a good, healthy environment.

As in other matters of Forestry, the particular manner of growing oak and the various kinds of trees that can most profitably be raised along with it, except in the comparatively few cases where it may be advisable to grow oak as a pure crop, will of course mainly depend on the local condition of the timber market. But in whatever manner oak be grown, it is essential to protect the soil against deterioration and consequent decrease in capital value as a producer of wood. On the better and the moister classes of soil, ash, elm, sycamore, and maple will in this respect deserve special attention as companions of the oak, while on drier land, particularly when of a limy nature, the beech is its most useful associate.

Accurate data as to the rate of growth of oak in British woods are not yet available on a sufficiently large scale to enable tables of average height, girth, and cubic contents to be framed for any or each class of soil. About sixty years ago the estimate was that an oak growing on a good soil and in a favourable situation should

contain about a ton of timber at seventy-five years of age. In the oak woods of Hanover the average yield on the better classes of soil varies from about fifty to seventy-five cubic feet per acre per annum for mature crops of pure oak harvested at 160 years of age; but this is of actual solid cubic contents, which must be reduced by more than one-fifth before it can be brought to the level of the 'square of the quarter-girth' method employed in estimating the cubic contents of standing trees or timber in the log in Britain. How careful one must be, however, in accepting statistics of this sort is shown by the fact that the total contents above the soil of highwoods of pure oak can vary from about 3600 up to 9600 cubic feet (true contents, not reduced by square-of-quarter girth calculation) per acre, according as the wood may be a thin crop on inferior soil, felled at 120 years of age, or a full crop on very good soil, harvested at 160 years of age (see p. 266).

In felling mature oak trees in Britain it is usual to bark them first of all; and this can only be done during the spring, when the sap is in most active flow. While the price of oak-

bark stood high—and formerly it commanded a good sale—the harvesting of this was an important operation in British woods, and even in the hedgerows where oak grew. This was another very good reason, in addition to the desire for curved timber for shipbuilding, for giving each tree a free space for growth and lateral expansion, as in hedgerows and copsewoods, because the number of branches increased the total quantity of bark, besides making it thick and rich in tanning properties. But the market has now fallen so much that it is often questionable if the advantage obtainable from the sale of the bark really compensates for obvious drawbacks attendant on the felling of big trees in spring, after most of the coppice in the copses has come into leaf. In the Selborne district of Hampshire the local price of the bark of large oaks fell from a very high figure formerly, to 67s. 6d. a ton in 1895, and down even to 40s. in 1899; and throughout the whole of Britain prices have greatly declined. With such low rates it often becomes questionable if the margin of profit over the cost of stripping makes spring felling and barking

remunerative, for the underwood will always be damaged most in spring. No sure market exists.

Perhaps in this particular matter, too, we may receive useful hints in considering what is done in other countries. In the oakwoods near Hildesheim, in Hanover, the big oak trees, when they have reached their full maturity and are marked for felling, are barked in late spring, when the flow of sap is most active. But as winter felling is preferable to the fall in spring, both on account of the greater durability of the timber and of the damage that must be done to the young crop on the ground, the barked stems are allowed to stand till the following winter. There is, it is true, the drawback of the loss of a season's growth, but this is outweighed by the seasoning of the timber and the growth of the young crop; for the overshadowing by the bare, dead stems is practically next to imperceptible.

This system seems worthy of a trial in Britain, because it has the additional advantage of not rendering sale of the timber necessary immediately after barking. The barked trees could remain standing till a suitable purchaser bought them, or till it was most convenient to fell and

log them for sale; and the longer they stood the better would they season, and the more should their wood accordingly rise in value.

Seasoning thus on the stool in the open air would also be much more thorough and more rapidly effected if the method of ringing or 'girdling,' which obtains in Burma with regard to teak trees, to season them and render them floatable, were at the same time adopted. This consists in cutting into the stem all round the trunk at the felling height, so that a ring of sapwood is entirely removed and the cut enters clean into the heartwood. The cleaner and deeper this wedge-shaped incision is made into the heartwood, the more rapid and the more thorough is the seasoning. Shortly after girdling, the sap throughout the whole of the tree above the 'girdle' becomes exhausted by the action of the foliage. As the upward flow of sap from the roots is thus quite cut off, the leaves very soon wither and die. Gradually the bark loosens its hold on the trunk and main branches, the twigs and smaller branchlets decay and fall off, while the dead stem remains gaunt and bare like a blasted tree, becoming seasoned and dried by

sunshine and wind till it be felled and removed. This would be no method for trees like pine or larch or ash, whose dead stems would soon furnish breeding-places for swarms of noxious bark-beetles; but it might prove advantageous for the treatment of oak. At any rate it seems worth a trial. The danger of damage from insects would certainly be removed altogether if 'girdling' and stripping of the bark of mature trees were undertaken simultaneously in spring.

This is, of course, no new suggestion. In *The Woodlands*, 1825, Cobbett says that 'with regard to the *felling* of OAKS, the OAK which is cut in *winter* is much more valuable than that which is cut in *summer;* but as OAK wood is OAK wood, and as Oak wood and *Oak-bark* will sell for more than the same quantity of Oak wood alone, we scarcely hear of such a thing as a winter-cut Oak. In order to have both; in order to have the skin as well as the body, and to have the body sound too, some persons have barked their OAKS standing, and cut down the trees the succeeding winter. This was practised, sometimes, hundreds of years back; but, if it had been of any solid utility; if it really had, in the end, been attended with

profit, the practice would have become general; instead of which, I never saw an instance of it in all my life. I have seen small Oak stuff, in the hedge-rows in Cornwall and Devonshire, thus skinned alive, and there may be here and there a man that applies the practice to large trees. But, at any rate, the practice is very rare, and very rare it could not be, if it were unequivocally profitable.' This method is only likely to be tried experimentally in woods managed on business principles; and a few experiments would soon show far better than any mere theoretical opinions, for or against, whether or not solid advantages are to be gained by adopting such processes. That the seasoning of standing trees can very easily be still further hastened, by simple and ingenious means, serious malpractices in the teak forests of Burma have long shown.

Within certain limits, something can be done by pruning to improve the stems of oaks that have been allowed to run prematurely in branches. But the operation requires care, and is often attended with danger, as will be more particularly referred to in chapter ix. (see page 288).

The decline in the price of tanning-bark has of

course also affected very prejudicially the remunerativeness of oak coppices grown specially for the production of this material. Under the early Tudor and Jacobean statutes, all the cutting of coppice for oak-bark was directed to take place from April till the last day of June, so that the young shoots springing from the stools should have time to become strong and stout before the early frosts came in autumn.

The treatment of oak coppice, in places where it can still be grown with profit, is extremely simple. In Belgium and Holland, along the Rhine, and in the adjoining districts, coppice woods of oak are still grown extensively, and yield good returns; but in Britain the growth of timber is in general more likely to be profitable. In oak coppice the crop should be as full as possible, and it should be kept free from admixture of other growth, whether hardwoods or softwoods, except in those places that show themselves unsuitable for the oak. The rotation in which the coppice can be worked, and consequently the number of compartments and the area of annual fall, vary greatly according to the soil, the situation, and the local climate. The best rotation is

that which will enable each fall to be made just at the age when the smooth bark, the 'pipe-bark' of the oak-stubbs, begins to become rough and fissured, because after that it contains less tannin than before. In favourable situations, with good soil and a warm southern exposure, the usual rotation is about fifteen or sixteen years, though varying of course from about twelve to eighteen years according to special circumstances; but a longer rotation is necessary for less productive soil and a cooler climate or a cold exposure.

For coppice woods the Durmast or sessile oak yields on the whole better returns in bark, and straighter and more vigorous shoots than the English or pedunculate oak.

In forming fresh coppices, or for filling up blank spaces, planting or else layering shoots from the nearest stools is much preferable to sowing acorns, as, though somewhat more expensive, it attains the desired object in a much shorter space of time. Except where the soil is shallow, copse-woods will be more likely than pure coppice to meet the general requirements of the market in the near future. Wherever coppices are desired to be transformed into copses, this can easily be

done by storing standards, though it takes a long time to gradually effect the change completely.

It may be observed with regard to oak, and the observation also holds good for all other kinds of woodland crops, that in the management of highwoods the rotation of the fall will be longest on the better classes of soil, while in copse and coppice the most favourable soils and situations permit the shortest rotation, and consequently give the largest area for the annual fall. This will be easily understood by the tables of average annual growth which will be found on pages 266 and 327. These show that when the crops are grown as highwoods for timber, the capital represented by the soil and the growing stock of wood will continue to give an increasing profit for a much longer term of years on good soil and in a favourable situation than on inferior soil and in an unfavourable situation. Or to put it in another way, the better the soil and the more favourable the situation, the longer will it pay, as an investment, to allow the timber to go on growing. Hence the business of Forestry is to ascertain and determine the time at which the maximum of profit is obtainable on the capital

represented by soil and timber; because whenever the annual increase in growth begins to show any fall in monetary value, as expressed *per cent.* on the capital, that is then the proper time to harvest the mature crop and raise up a new generation of trees to be likewise dealt with economically as an investment intended to produce the best income obtainable from the land and its timber crops.

In the case of copses and coppice woods, however, the more favourable the soil and the situation generally, the shorter may be the rotation without risking deterioration of the soil as a producer of wood and bark. The conservation of the productive capacity of the soil should always be one of the first considerations in fixing the rotation of copse and coppice; for the temporary advantage of short rotation, with frequent exposure of the soil to sun and wind, would be in the end dearly bought by gradual deterioration of the land. This would really mean diminution of its capital value; and that would be false economy, as well as bad Forestry.

It seems hard, when writing of the oak, so intimately connected with the greatness of Britain,

'Lord of the woods, the long-surviving oak'

to feel compelled to refrain from giving a few details about some of the many historical and interesting oak trees to be found in different parts of the British Isles. But as this is a book on Forests and Woodlands, and not on Trees, space unfortunately forbids our wandering along these seductive by-paths and discoursing on the more purely æsthetic side of British Arboriculture. As Evelyn said, Britain has been 'a nation whose only protection (under God) are her *Wooden Walls*'; and the unique value of the oak in the sixteenth to eighteenth centuries is epitomised in Pope's well-known lines—

> 'Let India boast her plants, nor envy we
> The weeping amber and the balmy tree,
> While by our Oaks the precious loads are borne,
> And realms commanded which those trees adorn.'

CHAPTER IV

In the Beechwoods

APPARENTLY it is not every lover of nature who can appreciate to the full the charm of the beechwoods. In single specimens the Beech (*Fagus sylvatica*) does not appeal to the poet in anything like the same degree as the oak. It has none of the sublime qualities of majesty and of endurance for many centuries against the destroying tooth of time. And yet, to the forester, few sylvan scenes can equal in quiet loveliness the dense beechwoods, thickly carpeted with fallen leaves, in which stately, smooth-barked, ashen-grey stems rise upwards in support of a

heavy crown of foliage of exquisite beauty alike in the tender green of spring, in the full vigour of summer growth, or in the rich russet-brown tints of autumn.

Gilpin, writing in 1791, had a poor, mean opinion of this tree both from an æsthetic and a utilitarian point of view. He does not even rank it among timber trees, 'as its wood is of a soft, spongy nature; sappy, and alluring to the worm,' adding also, 'in point of picturesque beauty I am not inclined to rank the beech much higher than in point of utility. Cobbett, too, treats it rather slightingly, for he has just as little to say about it in *The Woodlands* as about the cherry, and less than about birch or alder. But in spite of those opinions, there must yet be many among us who will concur in thinking Gilbert White's estimate a much truer one, when he speaks of '*beech*, the most lovely of all forest trees, whether we consider its smooth rind or bark, its glossy foliage, or graceful pendulous boughs.'

Among the older writers, favourable mention is often made of it. 'Yet have I known,' says the Holinshed Chronicles, 'great woods of beech and hasell in manie places, especialle in Barke-

shire, Oxfordshire, and Buckinghamshire, where they are greatlie cherished, and converted to sundrie uses by such as dwell about them.' This still holds good.

Since the time of Gilpin and Cobbett the economic importance of the beech has increased very considerably, and the prices commanded by it at present, running up to 1s. 6d. per cubic foot in Buckinghamshire and all around that district for chair-making and various other purposes, make it deserving of attention and of improved methods of treatment in all woods grown for profit on the chalky or limy soils abounding from there westwards, following the Hampshire Downs and the Chiltern and Cotswold Hills, into Gloucestershire. This particular local industry goes back a long time, for Evelyn mentions it among the uses of the wood, though he, too, considers beech 'neither so apt for *Timber*, nor *Fuel*.' The concluding portion of his also very short discourse on the beech illustrates one of the habits of continental life of old so graphically and suggestively as to be worth quoting: 'But there is yet another benefit which this *Tree* presents us; that its very *leaves* which make a

natural and most agreeable *Canopy* all the Summer; being gather'd about the fall, and somewhat before they are much *frost-bitten*, afford the best and easiest *mattresses* in the world to lay under our *quilts* instead of *straw;* because, besides their tenderness and loose lying together, they continue sweet for seven or eight years long; before which time *straw* becomes *musty*, and hard. They are thus used by divers *persons* of *Quality* in *Dauphine*, and in Switzerland I have sometimes lain on them to my great refreshment.' Throughout France and Germany beech is still the principal fuel used for domestic purposes, as its heating power surpasses that of almost any of our other woods.

The beech grows well on most kinds of soil that are of a fresh and light description, or on sandy soil resting on a subsoil of a loamy or marly nature; but its finest growth is attained on a limy soil. The chalks and marls of the ridges and spurs of the limestone hills forming the backbone of the southern counties of England still retain in many parts the remnants of their original covering of beechwoods; and though good returns are being obtained from such lands, there can be little doubt that the closer applica-

tion of business principles in their management might soon result in still better returns from these woodlands. Hardy though the beech be, and endowed as it is with a better capacity than any other broad-leaved tree for protecting the soil against the wasting effects of sun and wind by reason of its dense crown of foliage, this conservation of the productive power of the land can only be adequately secured and utilised to its fullest degree if the beechwoods are kept considerably thicker than is usually the case in Britain. With regard to no kind of timber has it here been customary to maintain such density of crop and such careful utilisation and protection of the soil as obtain in continental forests; yet if there be any difference as to climate for the regulation of a matter so important in its relation to the yield in timber, the advantage must lie with us by reason of the greater relative humidity of our insular climate. This favours the density of the woods by enabling the trees to bear a somewhat greater amount of shade, just as a greater wealth of foliage is to be found on cool fresh slopes than on hot dry exposures.

Certain indications were given towards the end

of the second chapter as to the apparent fact that prices in Britain for timber of all sorts are almost certain to rise considerably in the near future, and that this rise in price will be permanent and no mere flash in the pan. If these be duly considered and found worthy of acceptance, then the beech should henceforth acquire very much greater importance as a woodland tree than has hitherto been the case in this country.

Grown in pure crops as a timber tree, beech has on limy soil great value as a producer of income. But apart from this more or less local advantage, it will in many cases have a special value for assisting materially towards the best development of other and more remunerative kinds of wood by reason of its capacity for bearing shade, its protection of the ground through the overshadowing of its dense crown, and its enrichment of the soil through the formation of the best class of mould by the dead leaves thickly shed each autumn.

On account of its heavy crown of dense foliage it is ill suited as a standard in copse, or as a timber tree in hedgerows; but in highwoods of light-demanding trees like oak, ash, larch, and

pine, an admixture of beech enables all the different kinds of timber crops to attain greater energy of growth, and a finer development altogether, than when these are grown in pure crops. Even below the surface of the ground such an admixture of beech performs good service, as it contributes towards more thorough oxygenation of the soil through the great capacity of its heart-shaped root-system, while the symbiotic aid of fungi living within the rootlets also exerts a chemical action in improving the soil. These indirect advantages of the beech in improving the soil and the growth of other kinds of trees have not in the past been sufficiently recognised in Britain, though they seem deserving of recognition in a practical form wherever crops of timber may be grown for profit as a regular business, like farming.

Gayer, one of the greatest continental authorities, has said that it would be next to impossible to grow the better classes of hardwood without the assistance of the beech. Though this be true for the dry climate of the European continent, the case is fortunately somewhat different in our humid atmosphere. Thanks to our

moister climate, even the most light-demanding trees are not so emphatic in their need for light as in central Europe. Oak, elm, ash, maple, and sycamore all bear a considerably greater degree of shade here than in the interior of the continent. In many cases the three last-named kinds of trees—in general more valuable than the beech—should often, under suitable management, be able to take over the rôle of conserving the productivity of the soil by overshadowing it, and of protecting it against the drying and exhausting effects of sunshine and wind. And there can be little doubt that, in most parts of the British Isles, mixed crops of oak, elm, ash, maple, and sycamore will be—a sufficient protection of the soil being assumed—all the more remunerative, the less the proportion of beech introduced into them, except on soil of a chalky or very limy nature.

Even by itself, however, beech when grown in pure woods can yield no mean profit at the present moment. During a very interesting discussion on Forestry at the Surveyors' Institution in 1900, an estate agent practising in the Chiltern Hills district stated that well-managed

beechwoods were returning five times, and in many cases six times, the annual income that the adjoining agricultural land was yielding. No more profitable timber than beech, he asserted, could be grown in this district, because at that time his firm was able to make from 1s. 4d. to 1s. 6d. per cubic foot of the best trees, and from 10d. to 1s. 3d. for smaller and rougher timber. It is true that this does not compare with the value of oak and ash, but these classes of timber cannot be grown as 'a crop' in the same way that beechwoods are treated and thinned at frequent intervals.

The experience of Mr. Daniel Watney, a Past President of the Institution, was also much to the same effect. The best results from timber with which he was acquainted came from the Chiltern Hills in Buckinghamshire. In the case of the West Wycombe estate, with which he was concerned a good many years ago in the suit of *Dashwood* v. *Magniac*, the estate books for over 100 years showed the annual income from those woods as 30s. an acre. They are situated on the top of hills, on land which is not really fit for agriculture, and which if it were broken

up would, he said, not be worth 5s. an acre. And then it must be remembered that they are kept up entirely by natural regeneration, without any attempt at planting, and there seems no reason why, so long as chair-making goes on in that district, they should not continue to yield 30s. an acre per annum. The tables given on pages 266 and 327 show that beechwoods in Germany, on the better classes of soil, worked with a rotation of 120 to 140 years, give an average annual growth varying up to about 48 to 64 cubic feet (British measurement). It is sometimes more; and well-managed woods in the south of England should certainly not yield less. The profit such a largely enhanced yield represents is a very handsome one, which should make it worth while for owners to manage their woods on the most advanced economical principles. It is certainly the fault neither of our chalk soil nor of our humid climate that the returns per acre are not just as large here as on the continent—and they might easily be larger.

One of the chief characteristics of the beech as a forest tree is its dense foliage, indicating a

greater power of enduring shade than most of the other broad-leaved trees. The natural effect of this endowment is that when other trees are grown along with the beech, these must be from time to time protected against the latter during thinning operations, otherwise the beech would gradually crowd them out in course of time and grow gregariously, thus forming pure woods.

The coppicing power of beech is somewhat limited in comparison with that of most of the other broad-leaved trees of our woodlands. It is, indeed, only in comparatively few districts that beech-coppices prevail to any extent. It is really only suitable for coppice or as underwood in copse on limy soil, where the rotation is not below from twenty to thirty years. After about forty to fifty years of age the young trees, when once the bark has become thick and hard, lose their power of shooting from the stool. Hence the best treatment of the beech is to grow it as highwoods, and to reproduce it naturally from the beech-nuts or mast produced in fair abundance about once every three to five years.

When grown along with the oak, it is well to cut it out in favour of the latter at about seventy

to eighty years of age, and then reproduce it from seed and allow it to grow up as underwood, for the protection of the soil. When the crop of oak attains its maturity at about 150 years of age, the whole can then be felled, with simultaneous natural regeneration, assisted by planting to the extent that may be necessary to fill blanks and to secure a proper distribution of the oak in the new crop. At the same time an opportunity is then given of introducing more valuable trees, such as ash, larch, and the like, by planting them here and there, singly or in small patches, in spots specially adapted to their particular requirements.

On the continent the cultivation of highwoods of beech by natural regeneration from seed has been brought to a great degree of perfection. Where grown in pure forests chiefly for the purpose of being split up into fuel, the fall usually takes place concurrently with regeneration, during the eightieth to the hundredth year. When grown for timber, however, the harvesting of the mature wood and the formation of the new seedling crop generally begin about the ninetieth year and extend over about the next thirty years. This system gives, along with other advantages,

security against late frosts in spring, which seedling beech are rather apt to suffer from; for the beech requires a certain amount of shade and protection during its earliest stages of growth.

Under this system the total area under beech is divided into four main blocks, in which the crops vary from 0–30, 30–60, 60–90, and 90–120 years, and average 15, 45, 75, and 105 years respectively, counting from the middle of the period of regeneration. The natural regeneration is effected by means of three classes of fellings. First comes a 'preparatory felling,' when any other kinds of trees, such as ash, sycamore, or maple, growing in admixture with the beech, are removed. The extra light thus given to the beech promotes the formation of seed, and gradually hardens the smooth stems against sunburn, while the opening up of the leaf-canopy also favours the decomposition of the dead leaves and the formation of good mould within the next four or five years. On a limy soil preparatory fellings of this sort are sometimes unnecessary, as the cast foliage rots sooner than on loam or sand, and there is also more danger of the ground being overrun with weeds. In this

felling only the smaller and dominated stems are removed, so that about one-eighth of the cubic contents of the crop is harvested. At this stage useful preparation of the soil can be cheaply effected by driving cattle into the woods, or by leading swine there for pannage. Stunted, dwarfish, bushy saplings will usually be found self-sown before this; but as they seldom develop well, they should be cleared from the ground to make way for the regular crop of seedlings, while softwoods like birch or aspen should also be cut out as troublesome weeds.

The first time a good mast year comes round after that, a 'seeding fall' is made by removing from a quarter to one-third of the mature crop still on the ground, the trees left being preferably those girthing about forty to fifty inches at breast height, and having a shapely, high-set crown. The larger fall is made on rather dry soil, to allow the seedling crop to have the benefit of the night dews, while the smaller quantity is removed in places prone to a rank growth of weeds. The frequent driving of cattle through the woods and pannage of swine during the mast year are highly beneficial to the regeneration. Though

the pigs eat greedily of the beech-nuts, they break up the ground with their snouts and embed the seed well in the loosened soil.

The third specific felling, forming the 'gradual clearance' of the old crop, extends over a long period, during which the rate of increase on the trees is large and profitable. It begins when the seedling crop is about two years old, and the rate at which it proceeds is mainly dependent on the thriving of the latter. Where the seedlings seem to be suffering from want of light and dew-fall, the old trees must be removed; otherwise it is profitable to retain these trees so long as they do not interfere in any marked degree with the growth of the young crop. Every two or three years the area regenerated must be gone over, and such trees removed as may seem necessary. On dry, warm exposures the clearance has usually to be effected within about six or eight years after the good mast year from which the birth of the young crop dates, but on the average it extends over ten or twelve years from then, and may even be prolonged over fifteen to twenty years on a moist soil having a cool northern exposure.

Beechwoods require a fair amount of tending.

NATURAL REGENERATION IN DENNY OLD WOOD, NEW FOREST (1900)

(Note the contrast within and without the enclosure, which dates from 1870)

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During the early cleanings and weedings coppice-shoots of beech and other trees should be cut out, as well as suckers of aspen and self-sown birch. During the early thinnings the softwoods then found should be removed along with the suppressed poles among the main crop. The thinnings should be moderate, but repeated at intervals of about four or five years; and as the crop advances in age, the use of the axe should be somewhat anticipatory, to assist nature in determining the selection of the dominant and predominating stems. This is more particularly the case on poor, dry patches of soil, where the struggle for existence is usually longer and less decisive than on more favourable situations.

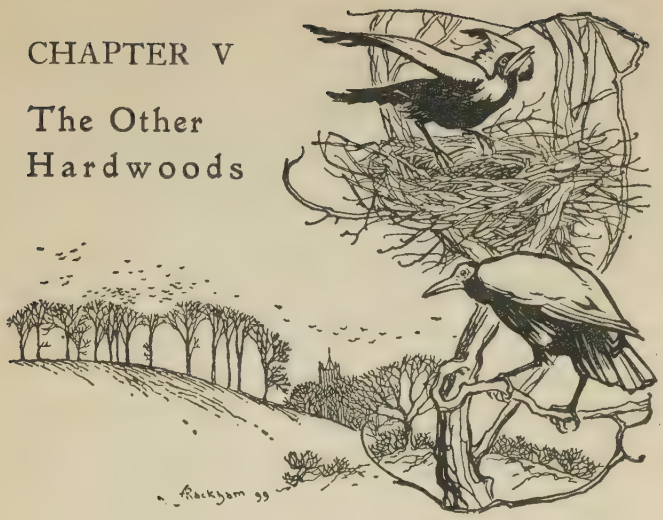
The result of such regeneration is that, when total clearance of the old trees has been effected, the young crop of beech is scattered over the area in larger or smaller patches of different height, and differing also somewhat in age. It is, therefore, usually not until about its tenth year that the young crop closes up and forms canopy. The further growth is then rapid, dense thicket being formed, much thicker than results from the treatment hitherto practised in England.

Throughout this early stage of development the average annual growth in height reaches about fifteen inches on favourable situations, and even increases to about nineteen inches among the predominant poles of twenty to thirty years of age. On soil of a less favourable character the growth is of course less, while it does not reach its maximum till from ten to fifteen years later. The thick fall of leaves, rich in potash, yields the finest class of woodland mould, so that at this stage of growth dense thickets of beech enrich and improve the soil in a greater degree than any other tree-crop. Stimulated thereby, the growth in cubic contents proceeds so vigorously that pure beech highwoods, on soils of only medium quality, yield over 6000 cubic feet (true measurement) per acre; but, unfortunately, only rather a small percentage of this is usually classifiable as first-class timber, the bulk of it being too small for reckoning as such.

The Buckinghamshire chair-industry grew up through the local supplies of beech; but now it is mainly dependent on imports of foreign wood, inferior in quality to that of home-growth. It is, therefore, a great pity we do not grow more beech.

CHAPTER V

The Other Hardwoods



OF the remaining hardwoods, the Elm has peculiarities which distinguish it from the others. Scots, Mountain, or Wych Elm (*Ulmus montana*), also known locally as wych hazel, is indigenous to Britain and seeds freely, but throws up few suckers; while the English or Common small-leaved Elm (*U. campestris*), a native of Italy introduced by the Romans and now forming perhaps the most typical feature in English rural landscape, in our cooler climate only forms germinable seed during exceptionally warm summers. To compensate for this, however, it

is endowed by nature with a strong reproductive capacity in throwing up stoles or suckers from its roots, in which respect it is only equalled by the aspen. Signs of uncommonly strong reproductive power are often to be seen in spring, when stems that have been felled, logged, and dragged out from the hedgerows in winter send out a flush of twigs here and there in making a final though feeble recuperative effort.

Both kinds of elm are easily reproducible by layering. Indeed, this strong reproductive capacity is often a curse to farmers, as the elm, when standing in hedgerows at the edges of fields and meadows, is prone to throw out shallow surface-roots, like the ash, from which suckers are apt to be sent up. In the spring of 1899 I saw long, thin elm root-strands interfering so much with the work of the plough that they had to be hacked through, and this even at a distance of thirty-five yards from where the tree stood. It is true that in this case there was a deep bank and ditch on the far side of the tree; but this shows all the same how hedgerow timber, ash and elm especially, can interfere with husbandry, by impeding the plough and by robbing

the soil of part of the food-supplies intended for the field-crops. And that always means a loss.

For proper development the elms require a warm situation and rather a fresh soil, as they transpire water freely through their foliage. Even when growing on what appears to be fairly dry land their deep, heart-shaped roots provide them with a considerable supply of moisture from the subsoil. Hence a warm, sunny exposure, as in avenues and parks, and a fresh or moist, deep sandy loam are where the finest growth of elm is to be expected. Though breaking early into leaf, it suffers little from late frosts. But the early frosts in autumn soon wither the yellowing leaves and bring them to the ground. Elm is a light-demanding tree, its requirements in this respect being often almost on a par with those of the oak. But as coppice on moist soil it often does fairly well under standards which do not overshadow it too heavily. The demand for light shown by elm trees of large size is, however, so pronounced that groups of pure elms do not long maintain themselves in close canopy; and this renders it unsuitable for growth in pure woods, even if this were profitable, which is

seldom the case. Holinshed's remarks, made more than three hundred years ago, are thus still applicable to-day: 'Of elme we have great store in everie high waie and elsewhere, yet have I not seene thereof anie togither in woods or forests, but where they have beene first planted and then suffered to spread at their owne willes.' And elm still abounds in many southern woods.

When oak was reserved mainly for the needs of shipbuilding, the uses to which Elm was put were many. '*Elm* is a *Timber*,' Evelyn says, 'of most singular *Use;* especially where it may lie continually *dry*, or *wet* in extreames; therefore proper for *Water-works*, *Mills*, *Pipes*, *Pumps*, *Ship-planks* beneath the *Water-line;* and some that has been found burried in *Boggs*, has *turn'd* like the most polish'd, and hardest *Ebony*, only discern'd by the grain: Also for *Wheel-wrights*, *Kerbs* of *Coppers*, *Featheridg*, and *Weather-boards*, *Dressers*, and sundry other imployments.'

During the last century hollowed elm-stems were used in London and other great cities for water-conduit before the introduction of leaden and cast-iron pipes, while it also commanded a high price for making the keels of large ships.

Most of it is now used for furniture, and for the never ending trade of making coffins.

Thriving well even amid the smoke of great towns, the elm is, through its graceful branch and twig formation, one of the best of our park trees. Unfortunately, however, it is apt to have its large branches and heavy limbs crack and fall without warning on hot, still days in summer; and this can only be prevented by a species of mutilation, such as is to be noticed in all the parks of London. A periodical cry goes forth in many newspapers against this so-called 'vandalism' on the part of the officers in charge of the Royal parks; but it is probably only through their careful and considerate action in carrying out toppings and loppings, though never wantonly and unnecessarily as is often represented, that so very few accidents have of recent years occurred in our much-frequented pleasure-grounds of the metropolis. One has to pay for this security.

As elm has so much in common with ash, maple, &c., when grown as part of a woodland crop, its treatment under such circumstances can best take place as subsequently described for these other hardwood trees all grouped together.

The Ash (*Fraxinus excelsior*) is one of the most useful and graceful of our forest trees. In grace and elegance it must, indeed, at times yield to the lone birch growing on the mountain side or by the edge of a lake or brook; but the ash has, both in the outline of its crown and the shape of its foliage, as also in the delicate bluish-green colour of the leaves, attractions which distinguish it above most of our other trees. Cobbett gave a due appreciation of the ash when he wrote, in his *Rural Rides* through Huntingdon, that 'In the hedge-rows, in the plantations, everywhere the ash is fine. . . . We have no tree that attains a greater height than the ash, and certainly none that equals it in beauty of leaf. It bears pruning better than any other tree. Its timber is one of the most beautiful; and as underwood and firewood it far excels all others of English growth.'

It is now much too valuable for fuel, and in any case beech is better for that purpose. But ash is at the present moment one of the most profitable trees that can be grown. The best ash, that of Nottingham and Leicester, fetches, dressed and ready for coach-builders, up to £11

per ton, or nearly 4s. 6d. a cubic foot. Even in the rough log well-grown ash can command about 2s. a cubic foot, and often considerably more; while the coach-building, agricultural implement, and furniture trades would be glad to have far larger supplies of it than are at present obtainable in Britain, because British ash is of better quality than that imported from abroad. No timber grown in our woods can compare with it in toughness and elasticity, and its value as a timber tree is increased by the rapidity of its growth, for timber of the finest quality can be obtained at about sixty years of age. Even the small produce of coppice and underwoods is valuable for hop-poles, crates, and the like, while in some places as much as £15 an acre is, under favourable circumstances, obtained for ash-shoots cut for walking-sticks and umbrella-handles. 'I have been credibly inform'd that one *person* hath planted so much of this one sort of *Timber* in his life time as hath been valu'd worth fifty thousand pounds to be bought. These are pretty encouragements for a small and pleasant industry.' Thus wrote Evelyn nearly 250 years ago; and what was then worth £50,000, would now be

worth something between five and ten times that amount according to its quality and dimensions. But ash had more than a mere market value in those ancient days. Gilbert White tells us how pollard ash trees were still standing which had been cleft and held asunder by wedges, so that ruptured children, stripped naked, should be passed through the cleft; and as the parts of the tree, beplastered with loam and swathed in bands, grew together again, so the babes became cured of their infirmity. This virtue is gone, alas! in these cynical matter-of-fact days of little faith.

Another curious piece of old folk-lore was the veneration paid to the 'shrew-ash,' usually some old pollard tree, whose twigs and branchlets, used as stroking-rods, had the power of curing horses, cattle, or sheep of the pain in the limbs and anguish caused by a shrew-mouse running over them—or what we now call rheumatism, and ascribe to other causes. A 'shrew-ash' was made by boring a hole into an ash-stem, placing a live shrew-mouse in it, and plugging it in while reciting quaint old incantations. Medicated in this way the shrew-ash retained its healing virtue so long as it lived, and in the good old days every

village and each farmyard had a tree of this sort always ready for an emergency.

Ash is in all respects a hardy tree, though it is very apt to lose the terminal buds of its shoots. This soon produces a typically forked habit of growth, favourable to the production of prettily-grained furniture wood, but spoiling the bole for ordinary technical purposes. It is a very common tree in hedgerows, though it does great damage in the fields by sending out long surface-roots. It accommodates itself to most soils and situations not too high-lying and exposed, but its most vigorous growth and its best development are attained on a fresh, deep, light, loamy soil, and on land of a somewhat limy description. On heavy clay land or dry sandy soil it often grows but indifferently, and at an early age shows signs that the situation is not suitable for it. Having a high rate of transpiration through the foliage, it requires to draw a considerable quantity of moisture from the soil, and in dry localities it is one of the first trees to shed its leaves in early autumn. Hence moist situations suit the ash, although not such places as permit moisture to collect long and stagnate in the subsoil.

The ash does not, like the elm, attain any great longevity. Its remarkable maturity in woodlands is obtained about the age of seventy or eighty years. On the most favourable classes of soil it will often pay well only to fell it at eighty or a hundred years, but in less favourable situations it may have to be harvested at about sixty years of age to escape the danger of becoming black in the heart and unsound in consequence of a fungous disease caused by *Nectria ditissima*, that often becomes epidemic. Particularly common on soil of a very limy nature this disease soon works its way up from the butt into the top of the bole and the main branches, and renders the tree unfit for timber. Where prevalent the disease often attacks the ash while still in the earlier stages of growth, and promising young plantations are sometimes very speedily and completely ruined from this cause. Seedlings also suffer, on a soil unsuited for ash, from another fungous disease due to *Phytophthora omnivora*, which also often attacks beech seedlings at the time of their germination and kills them in large numbers.

Wherever seed-bearers are in the immediate neighbourhood, ash comes up freely on most

kinds of soil. 'Ash cometh up everie where of it selfe, and with everie kind of wood,' Holinshed truly remarks. In some of the beechwoods of the Cotswold Hills the seedling growth of ash comes up thick and beautifully—only, in many cases, to be eaten down by rabbits. Strongly endowed as it is with recuperative power in outgrowing injuries, even the ash cannot outlive being eaten down year after year by rabbits.

It also springs very freely from the stool, throwing up a fine flush of straight rods of vigorous growth. As coppice and underwood in copse it can stand a fair amount of overshadowing on good fresh soil, and even benefits by a light shade protecting it against frost, while under favourable circumstances it also throws up suckers as well as stool-shoots. During the later stages of its growth it exhibits distinct signs of being essentially a light-demanding tree, like the oak and the elm, and therefore becomes impatient of shade. Like them, too, it is apt to become dry-topped and stag-headed if suddenly exposed to light when a large tree. With its deep roots, light foliage, and tough wood, it, however, differs entirely from the elm in being little

liable to be thrown or broken by wind. Along with the oak and the larch it forms one of the most profitable kinds of trees that can at present be grown as standards in copsewoods. Indeed, owing to the much larger number of trees that can thus be retained as standards without unduly overshadowing the coppice, ash and larch will in many cases prove far more profitable than oak in this respect; and such is certainly one of the best and most natural methods of growing ash.

On marshy lands of the better class, where oak can be grown with advantage, a sprinkling of ash often improves the growth of the crops; and patches of ash in the better parts of the alder groves can be made to add considerably to the returns, such patches being underplanted during the later stages of their development. At the present moment the cultivation of ash on soil suitable for its growth promises to be a very remunerative sort of investment, while the facts that it seeds freely, can be propagated so easily, and can be grown to the best advantage in mixed crops along with beech, oak, maples, &c., make it comparatively easy to raise and handle as part of a woodland crop readily saleable.

All of the three kinds of Maple frequent in Britain, the Common or Norway Maple (*Acer platanoides*), the Sycamore, Great Maple, or Scots Plane (*A. pseudoplatanus*), and the Hedgerow or Field Maple (*A. campestre*), can be reckoned among the trees of the woodland. But the last named is only to be found in and about hedges or here and there among the underwood in copses, whereas the other two larger species not only thrive in the undergrowth, but also form valuable timber trees, especially when grown along with beech in rather moist localities.

In Evelyn's time maple and sycamore timber was in good repute. 'The *Timber* (of Maple) is far superiour to *Beech* for all uses of the *Turner*, who seeks it for *Dishes*, *Trays*, *Trenchers*, *&c.*, as the *Joyner* for *Tables*, *Inlayings*, and for the delicateness of the grain when the *knurs* and *nodosities* are rarely *diapered*, which does much advance its price: Also for the lightness (under the name *Ayer*) imploy'd often by those who make Musical-instruments. But there is a larger sort, which we call the *Sycamor* . . . is excellent for *Cart* and *Plow-timber*, being light, tough, and not much inferior to *Ash* it self.' By the

eighteenth century, and far into the nineteenth, the fashion had changed; for there is a fashion in the use of different woods, and it is not necessarily the best kinds that can be brought with profit on the market. Thus Gilpin says of the maple, 'Its wood is of little value, and it is therefore rarely suffered to increase'; while Cobbett, in a passage very characteristic of his general style, says, 'It is mere brushwood; and of no more use as a tree, than the poppies, or wild parsnip, or wild carrot, are as cattle-food. Our Maple is a weed of the woods, and we burn it, because we know not what else to do with it. . . . The timber of our Sycamore is white and soft, and not valuable by any means.'

Fashion, shaped no doubt by necessity, has again swung back to the good opinion of the wood of both maple and sycamore held two hundred and fifty years ago. Sycamores of large size and good growth can be sold at prices running up to over two shillings a cubic foot, and much the same price could be obtained for maple if large supplies of it were available. And the capacity of both of these excellent timber trees for coming up as 'a weed of the

woods' gives the clearest indication possible that their cultivation should be encouraged as largely as may be profitable in copses and high-woods. Their rapidity in growth is often remarkable, and they should often prove a good source of revenue in well-managed woodlands. Sycamore and maple planted in 1868 to 1871, upon high land on the Earl of Selborne's Blackmoor estate in Hants, girthed up to three feet in September 1899; and they had already begun to seed very freely in blank places throughout portions of the plantation. Here is a description of this small plantation, formerly an oak grove, of 2½ acres known as *Highfield copse:* 'A good, deep, fresh soil varying from sand to sandy loam, sloping very gently towards W., at which end the soil is a loamy clay. A mixture of Oak, from 4 to 6 feet in girth, originally standards in copse, with Sycamore, Maple, Elm, Lime, Beech, and other trees planted about 1868 to 1871. Some of the Maple and Sycamore now girth up to 3 feet at breast-height. The crop now forms full canopy in places, but in others there are blanks; and in some of the blanks self-sown sycamore are coming up abundantly.

Where it still exists, the coppice is mostly of hazel, but patchy, with birch here and there.'

In woodlands managed on business principles, mainly for profit, sycamore deserves to receive the preference, because it is more truly the tree of the woods than the maple; while the latter, one of the first trees to flush into leaf in spring, and with light yellow autumnal foliage contrasting well with the dark greens and russet hues of other trees, will always in parks and ornamental portions of estates claim the advantage over the sycamore with its heavier foliage, its greater tendency to run into big branches, and its altogether more formal and gloomier aspect.

As forest trees, both are energetic in growth, and can attain dimensions as large as the oak or the beech. They have both rather a tendency to run to branches, which can only be checked by keeping them in somewhat close canopy. Grown along with beech, they soon shoot ahead of it in upward growth, but later on they are overtaken. Then they must either be thinned out or else protected by cutting out the beeeh interfering with them, whichever operation promises to be ultimately the more profitable.

Like the ash, both maple and sycamore coppice freely and can stand a considerable amount of shade while young. But as they grow up into trees they show signs that, except on good, fresh land, they then require a considerable amount of light to thrive well. Though not so emphatic as oak, ash, or elm in their demand for light, they are neither of them, not even the sycamore, capable of bearing shade so well as the beech. This becomes apparent if the interior of the crown of foliage be examined, when it will usually be found that what looks like density as viewed from outside is rather due to the completeness of the exterior foliage than to any great production of leaves within the crown, and that this seeming closeness of foliage is superficial rather than real and solid. On poor and somewhat dry land the requirements for light become of course more marked than on good moist land ; but in many of the oak groves and copses a free admixture of maple and sycamore will often be able to protect the soil much in the same manner, though perhaps not altogether to the same degree, as beech ; and wherever this may be the case, the maples are more likely to yield a fair profit than the beech.

When such woods are being coppiced, the maples should be felled close to the ground, as the soft stools are otherwise apt to decay prematurely. As they are also apt to lose their reproductive power after being coppiced once or twice, renewals will have to be made if self-sown seedlings be not abundant; and layering of outside shoots will often prove the cheapest and easiest method of providing the new crop or thickening the old one.

Both maple and sycamore thrive best in rather humid localities, and near the sea-coast. A considerable amount of soil-moisture is also requisite for their best development, and the finest growth is attainable where there is a fair amount of moisture both in the soil and the subsoil. Where the land is wet or the subsoil water-logged, however, their larger development is apt to be checked, and they remain stunted, or die off prematurely. Except as regards damage from late spring frosts in damp, low-lying localities they are hardy trees, and they are not at all difficult to grow on average soil. Few of our forest trees, indeed, thrive on so many different soils and situations as sycamore, which does well on all

sorts of lands from light sand to stiff clay, and from low-lying, but well-drained, sheltered tracts up to the breezy uplands, and even on wind-swept exposures. But, as with most of the hardwoods, good loam of course suits them best, and especially land containing a fair amount of lime. They are, therefore, both eminently suitable, but particularly sycamore, for growth in the beechwoods of the Chilterns, Cotswolds, and other hills in the chalk districts—wherever profitable.

Like the ash, they attain their physical maturity and reach remunerative marketable dimensions at a much earlier age than oak. In many cases they will perhaps yield the best returns at about sixty to seventy years of age, although it may often prove advantageous to let them stand till eighty or ninety years or more, where timber of large dimensions is specially well paid.

The Sweet or Spanish Chestnut (*Castanea vulgaris*), the *Fagus* which Julius Cæsar remarked that he did not find growing here, and which was one of the trees introduced into Britain during the Roman period, resembles the oak in its general appearance at a distance, its longevity, its deep root-system, its broad crown, and strong,

spreading gnarled branches, and in the general appearance and the great durability of its timber. Many of the great beams in old churches and other buildings are of this wood. In parks, the rich golden colour of its foliage in autumn forms a beautiful contrast to other trees with darker leaves, but as a tree of the forest it is not so profitable in the highwoods as many of our indigenous trees. Here it makes considerable demands on warmth of situation, or sheltered localities, and though very moderate in its requirements as to mineral strength of the soil, it needs a deep sandy or sandy loam to make really good growth. Cold land and stiff clay are not favourable to its development; even stony or gravelly land, warm and well sheltered, is better than these. It does not thrive at all on limy land, and even a small percentage of carbonate of lime in the soil at once affects its development. Another drawback to its cultivation in highwoods is that it often at about the age of fifty to seventy years becomes unsound with *ring-shakes*, which spoil it for beams and scantling. Its wood is useful for such purposes as gate-posts, fencing, hop-poles, cask-hoops, and the like, all of which are procurable from coppice-growth.

Rarely maturing its seed in Britain, like the other non-indigenous trees, English elm, lime, poplar, and some willows, it has a very strong reproductive capacity both in the form of stool-shoots and root-suckers. It shoots freely from the stool, and the stubbs retain their coppicing power for a very long time. Indeed, in reproductive power it excels any indigenous tree, as stools can throw out shoots even up to about one hundred years of age. Hence it forms an excellent underwood in copses where the overshadowing is not excessive, though it can hardly be truly reckoned among the shade-bearing kinds of trees. Grown as coppice under standards of larch, Scots pine, and oak, it can often yield good returns on land of a deep sandy nature; and in conifer plantations requiring underplanting it may be found worthy of favourable consideration. On rather poor classes of land, except where it is apt to suffer from late frosts in spring, it will sometimes yield better returns as coppice than any other kind of underwood. It therefore seems specially adapted for the underplanting of old larch and pine woods which have become so open in canopy as to be unable any longer to protect the soil from the ex-

hausting and deteriorating effects of sun and wind. When thus forming underwood it should be cut over for the first time at about ten years of age, and then worked with a rotation of about fifteen years till the overwood comes to the fall. In cutting coppice, low felling, close to the ground, should always be the rule, but in addition to this the reproductive capacity of the chestnut for throwing up shoots and suckers is increased by heaping earth on the stubbs that are left. As coppice it protects the soil well, and enriches it with a good mould. Hence, where small material is remunerative, coppices of chestnut can be worked with a lower rotation than any other kind of crop, except hazel or ash and osier-holts, without unduly exposing the soil to deterioration.

As previously remarked, ash, maple, and sycamore are all trees well worthy of cultivation in highwoods, and the treatment is much the same for all the three. But as regards each of these, its proper position is that of a subordinate tree growing along with others, and best of all with beech, of a somewhat slower growth and better able to protect the soil against deterioration. On many a hillside, dingles and small water-courses

will be found where growth of ash can be profitably encouraged; while on good, rather moist, low-lying patches of ground a mixture of oak, ash, maple, and sycamore, or even of willows and alder on wet spots, may add materially to the returns obtainable. When grown along with oak principally, it will perhaps usually be most profitable to fell them about their sixtieth or seventieth year, to be followed by underplanting for the benefit of the main crop; whereas, if grown with beech, they can remain as long as they are sound and continue to increase at a profitable rate. No dogmatism can be safely hazarded as of general application in such cases, for the whole of the operations of Forestry are so essentially ruled by local considerations and market requirements, that only the principles of management can be broadly sketched; while these very principles themselves, as well as their particular application, must be modified by whatever promises to be most advantageous under the given conditions and the future prospects of the local timber market.

If grown in highwoods with oak, the ash and sycamore will often, on being felled and removed,

throw up a sufficient crop of stool-shoots, together with ash-suckers, to obviate any necessity for spending much in the formation of underwood; and if the canopy has been at all light previously, there may be quite a large number of self-sown seedlings on the ground, chiefly of sycamore. Where such conditions obtain, on the better classes of woodland soil, a fair undergrowth may often be formed with comparatively little outlay except for layering of stool-shoots springing up freely near blank patches, and the returns from this should soon prove remunerative enough to form 'pretty encouragements for a small and pleasant industry,' as we have seen Evelyn already point out long ago, with regard to the ash.

Other two hardwood trees of minor importance in Britain are the Hornbeam (*Carpinus betulus*) and the Robinia or Locust-tree (*Robinia pseud-acacia*). Yet they each deserve attention as yielding good timber of a very hard, tough, and durable kind.

Hornbeam is seldom allowed to reach its attainable dimensions as a timber tree, being mostly relegated to hedges, though under favourable circumstances it can grow to a height of

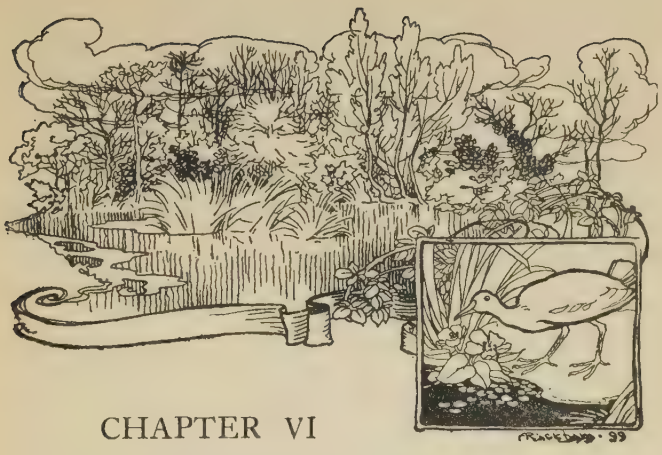
sixty or seventy feet, with a girth of from two to three feet in diameter. Its hard, heavy, cross-grained wood is difficult to work; but it is better than beech for such purposes as work-benches, boxes for planes, handles of tools, wedges, hubs of cart wheels, and anything requiring great toughness. And it is the only one among our forest trees whose wood exceeds that of beech in heat-producing power as fuel. Chalky land does not suit it well, while its best dimensions are attained on stiff clayey soil, or moist loamy sand and marshy land. Dry shallow soil and a warm exposure are not favourable to its growth as a tree, though it still coppices very freely there. Shade-bearing like the beech, and hardy against frost, it may sometimes be of use for under-planting in places that are too moist for that tree, or for good growth of the more profitable ash, hazel, maple, sycamore, and the like. Deep felling in coppice-woods makes hornbeam throw out stoles as well as stool-shoots. As it reproduces itself freely as underwood, it may often be of use in filling up blanks in damp frost-holes where nothing more profitable can be made to grow.

The Robinia is deserving of more attention than it has yet received as a timber tree. Rapid in growth, and hardy in most parts of Britain, it produces a good, heavy, hard wood, durable for both outdoor and indoor work. Tough and elastic, it is specially suitable for wooden pins in deck-planking and similar uses. It is easy to work, but much handling of it is apt to cause sores occasionally, owing to some irritant secretion it contains. Lighter than oak, ash, or maple, it equals them in durability. It can be grown on all lands of a light or sandy description, and can thrive, thanks to the symbiotic aid of a fungus, on very poor land—a characteristic it shares with many other leguminous plants. But its finest growth is in warm localities, free from late frosts in spring and sheltered from heavy winds. Where such land lies vacant in the vicinity of hop-districts, robinia coppice worked with a rotation of ten to fifteen years should often prove remunerative. Even small thinnings of coppice could yield good withes and hoops for casks, hurdles, and the like. It seeds freely and can be easily regenerated, and the bean-pods are toothsome to cattle.

Among hardwood shrubs Hazel (*Corylus avellana*) deserves far more than mere passing notice. It often forms a very profitable coppice yielding good small material for hurdle-making, bean and pea sticks, crates, cask-hoops, and such like. Indeed, in many parts of southern England, as in portions of Gloucestershire away from the districts where hop-poles are in special demand, this hardy shrub is sometimes certainly entitled to be considered one of the most profitable kinds of coppice, when grown either pure or mixed with ash. If freed from overshadowing by standard trees, hazel grows very vigorously and becomes marketable in about seven years' time. Its finest growth is obtained on land of a loamy or clayey description. There is no special difficulty about its cultivation, the main point requiring attention being to see that blanks in the stock are carefully filled at each fall of the crop—and rabbits killed.

Of all the hardwoods dealt with in this chapter, ash is best suited to be grown as a standard tree in copses, either by itself or else along with oak. Its natural habit of growth gives it peculiar qualifications for such a position, and the present

prospects of the timber market point to the ash being an exceedingly promising form of woodland crop. But a detailed consideration of its treatment, either as a standard or as underwood, will more appropriately find a place in the chapter on Copsewoods (see page 291).



CHAPTER VI

The Softwoods—Alder, Birch, Aspen, Lime, Willows, & Poplars

THE Common Alder (*Alnus glutinosa*) indigenous to these Isles is still a very much more common tree than the Hoary Alder (*A. incana*) introduced by the Romans; and only the former is of any importance in our woodlands. Hardy, suffering but little from late frosts while easily repairing the damage thus done, and not injured much by temporary inundations, it is to be found along the margins of most streams and rivers, and in marshy lands even of a boggy description. As Evelyn truly remarks, 'The *Alder* is of all other

the most faithful lover of *wattery* and *boggy* places, and those most despis'd weeping parts, or *water-falls* of *forests*.' Moisture is indeed a necessity for it, as it can make no great stand against drought; and it thrives on land that is even too wet for willows and poplars. But, whenever the land becomes too dry for good growth of alder, a more profitable kind of crop can easily be raised. On the waste, swampy lands where alder is now mostly to be found, self-produced and often little cared for, want of management allows it to spread greatly and run much into branches; whereas, if it were kept in something like close canopy, it could easily be made to attain a height of about fifty to sixty feet, with a proportionate girth on favourable soil, and to give a good yield.

The wood and the bark of the alder are in less repute to-day than they once were. Like elm timber it is durable for use underground, or, if kept dry, in places where there is no frequent alternation from damp to dry atmosphere, the conditions favouring attacks of destructive fungi. All the softwoods, in fact, are much more durable when thus preserved against damp, and this

circumstance gave rise to such rural adages as that about alder in Dorset—

> 'Thatch me well and keep me dry,
> Heart of oak I will defy.'

In the midland counties the same idea is expressed in very similar words as regards poplar and willow, once much used in house-building.

Alder wood is largely used for making herring barrels and as charcoal for gunpowder; while on the continent it is much used for cigar boxes. Its superiority for gunpowder has long been known, at any rate since before the days of Evelyn: 'The poles of *Alder* are as useful as those of *Willows*; but their *coals* far exceed them, especially for *Gun-powder*.'

Before that, however, it had also other minor uses, for the Holinshed Chronicles speak of 'the alder, whose barke is not unprofitable to die blacke withall, and therefore much used by our countrie wives in colouring their knit hosen.' In localities where the wood can be disposed of profitably to a powder factory, or for clog-making or other purposes, alder coppice can still prove profitable. But the better classes of land, which would yield the largest returns, can, in the great

majority of cases in Britain, be cultivated more remuneratively than under crops of alder coppice, the form of treatment most suitable for this tree. The returns may vary very widely, however, according to the general quality of the soil and situation.

Where the larger sizes of alder are marketable, coppices can be worked even with a rotation of forty to fifty years without outreaching their capacity of shooting again from the stool. On inferior classes of soil, however, it is best to keep the rotation down to about twenty years. Alder coppice has, more than any other kind of coppice, strong resemblance to a young highwood crop, because two or three dominating shoots soon forge their way ahead and suppress the weakling rods; for, although on good, moist, loamy soil it can bear a considerable amount of shade, the alder really requires a large amount of light on land not particularly suitable to its growth or meeting its special requirements.

Alder is well worth attention and cultivation on low-lying land, while a judicious sprinkling of ash and oak on the better patches of ground can often be made to add considerably to the value of

the crop. In all such cases, however, the question should first be considered whether a little expense in drainage and then a much larger proportion of ash, sycamore, and other trees may not promise more solid advantages than crops mainly of alder.

The best time for cutting alder coppice is when the ground is frozen hard, while the fall must be at once brought out to the drier parts. The drawback to this is that the stools are then rather apt to chip. If the land be not too marshy for late autumn or early spring felling, then the main point to be considered is the danger of flooding at the time of the flush of the leaf. Where this is to be feared, it is well to leave a stump to protect the shoots against immersion and against rank growth of grass and other weeds; otherwise, of course, the curfe should be low down, almost flush with the ground. In filling blanks and thus keeping a good density of crop, planting is preferable to sowing, as such places are usually prone to a strong growth of weeds, apt to choke the young seedlings.

Own cousin to the alder botanically, the Birch (*Betula alba*) is often found growing along with it in marshy land, though less frequently by the

sides of slow streams meandering through pasture lands, where willow, poplar, and hazel are its chief associates. The birch is the most graceful of all our forest trees. Whether as a tree of the mountain, rising up from the heather-clad hillside, —where its silvery bark forms a beautiful contrast to the dark-coloured heather, while its small and delicate light-green foliage stands out clear against the blue sky,—or hanging gracefully and pendulously over the margin of a lake or by the bank of some murmuring brook, there are few trees in all the wide world which can well compare with the birch either in the grace of outline or in the delicacy of its beautiful colour; and there is perhaps none which can surpass it in its charming combination of these two picturesque qualities. Small wonder, then, that it has been so often sung by the poets and painted by the artists of Britain. Its quiet charm is the leading feature in such pictures as M'Whirter's 'Three Graces' and 'The Lady of the Lake.' The same charm also called forth Coleridge's admiration of it as

'most beautiful
Of forest trees—the Lady of the Woods.'

But more graphic still is Scott's fine descriptive couplet, telling how, as the poor, aged Last Minstrel rode along by the lowland river,

> 'He passed where Newark's stately tower
> Looks out from Yarrow's birchen bower.'

The most graceful and delicately beautiful of all our forest trees, it is at the same time one of the hardiest. Indeed, but for the aspen, it would be absolutely *the* very hardiest of all of them. The only other of our forest trees which can at all compare with it in power of accommodating themselves to poor soils and to extreme variations of summer warmth and wintry cold, are the Scots pine and the aspen; and the latter is the only tree whose geographical distribution, throughout 35° of latitude and 140° of longitude, exceeds that of the birch. As regards its power of accommodating itself to different kinds of poor soil, nothing can well be added to what Evelyn wrote when he said of the birch that the land on which it is possible to grow it 'cannot well be too barren; for it will thrive both in the dry, and the wet, Sand and Stony, *Marshes* and Bogs; the *water-falls*, and *uliginous* parts of *Forests* that hardly bear any grass, do many

times spontaneously produce it in abundance whether the place be high, or low, and nothing comes amiss to it.'

One lingers fondly over gentle John Evelyn's appreciation of the beautiful birch. Even for '*this despicable tree*' he has a good word: 'For though Birch be of all other the worst of *Timber;* yet has it its various uses, as for the *Husbandmans Ox-yoaks;* also for *Hoops*, *Paniers*, *Brooms*, *Wands*, *Bavin* and *Fuel; great* and *small-coal*, which last is made by *charking* the slenderest *brush*, and *summities* of the twigs; as of the tops and loppings M. *Howards* new *Tanne:* Lastly, of the *whitest* part of the *old wood*, found commonly in doating *Birches*, is made the grounds of our *Gallants Sweet-powder;* to say nothing here of the Magisterial *Fasces*, for which antiently the Cudgels were us'd by the *Lictor;* as now the gentler *Rods* by our tyrannical *Pædagogues*.'

To-day the wood is not yet in good repute, as it is not durable unless creosoted or naphthalined. Like the alder it is used for gunpowder or as staves for herring-barrels, and for making reels or bobbins for thread-factories, for which purposes branches down to one inch in diameter can be

utilised. Many of the trees in the Scottish highlands are thus utilised although little indeed is done to improve the growth of the trees or to make them yield a better class of wood suitable for furniture, turnery, cartmaking, and the like.

Birch is, on land of rather a wet than a dry nature, very frequently found growing along with the Aspen or Trembling Poplar (*Populus tremula*), 'whereof our fletchers make their arrowes,' as the Holinshed Chronicles tell us.

Indeed, in olden times the aspen was the most important of all our softwoods, for as arrow-wood it was of special value before the invention of gunpowder and fire-arms. Thus the Statute of Woods (1543) ordered that preference should of course be given to oak for shipbuilding—but, failing a sufficient number of oak, then 'elm, ash, asp, or beech' were to be stored as standard trees in the copsewoods, these being, next to oak, the most valuable of our timber trees at that time

As trees of the woodlands there is so much that is common to both birch and aspen that they can most conveniently be treated of together. They are both essentially light-demanding trees; in fact, they make greater demands on light than

any other kinds of broad-leaved trees. Like all such trees, they have a deep root-system,—though the direct connection between deep roots and a very pronounced demand for light, as in oak, larch, and Scots pine, is not clear. By means of these they are enabled to obtain a good supply of water from deep down in the subsoil, even when the surface of the ground may appear dry. But birch and aspen possess, in the most remarkable degree among all the other light-demanding trees, the two characteristics of rapidity in upward growth and of thinness in foliage. Their hardiness against frost, their rapidity in growth, and the comparative lightness of the shadow they cast around them, qualify them excellently, and especially the birch, for acting as a nurse to species like oak, ash, chestnut, beech, &c., in places where these are likely to be nipped and damaged by late frosts in spring. When once such kindly offices have been performed, however, birch and aspen should be at once cut out, else they only interfere with the growth and the healthy normal development of the more valuable young trees desired as the crop. Even then much trouble is often caused

by the stool-shoots of the birch and the suckers thrown up in profusion by the aspen, as both trees are strongly reproductive when thus felled. It is often wonderful how long a hold on life the roots of aspen seem to have; for the suckers often spring up very freely when mature crops of timber are being felled, even though it be many years since the aspen have been cut out. And such stoles can prove noxious weeds before they are finally suppressed in favour of the new crop about to be formed. This of itself unfits the trembling poplar for standards in copse, though otherwise the light overshadowing of the underwood would well suit the position—

> 'And variable as the shade,
> By the light quivering aspen made.'

On highwood areas clear-felled for regeneration, as sometimes happens with conifer crops, birch, aspen, and willow, the trees producing seed in largest quantities, and especially the first two, often spring up freely as self-sown seedlings; and then they become weeds difficult to exterminate owing to their strong reproductive power and to their rapid growth in height. Their removal, before regeneration is carried out on the

neighbouring land, becomes a matter of necessity; while, if seedlings should obtain a foothold there, they must be cut out repeatedly if necessary, otherwise the new crop of more valuable pine or larch will be interfered with by the usually less profitable softwoods. Again the very true proverb applies, about ill weeds growing apace.

As their seeds are light and filamented, they are easily borne by the winds into far-distant copses and highwoods, where they often find growing-space in blank spots, and there seize hold upon the ground. Certainly, such portions of a crop are better than vacant patches producing nothing; but, without a good market, prevalence of sporadic birch and aspen in coppices, copses, or highwoods is more frequently the sign of slovenliness, neglect, ignorance, or apathy, than of the most profitable methods or of business-like management; though it is of course different if merely a few well-grown birch stems are held over to form standards above a good thick underwood in copse, where oak or ash of suitable size is wanting among the overwood. Aspen is less suited than birch for occupying such a posi-

tion, as its bole often begins to become unsound before attaining the age of forty years.

In certain cases, however, birch—and aspen and other softwoods also, where the wood can be sold to match or wood-pulp factories—may be grown profitably on poor land of rather a wet description, or on sandy soil where relief is desired from the dreary monotony of woods of Scots pine. If here planted in pure patches, it quickly shoots up in growth ; but it soon begins to become much broken in canopy, and then the best thing is to thin out the plantation and underplant the birch with some sort of shade-enduring tree that may promise to be a remunerative crop on land of the given description, the standards being removed whenever the best financial moment seems indicated by consideration of the state of the underwood. In general, birch will have reached its maturity between the age of forty to sixty years.

The best development of birch and aspen is attained when they are grown along with alder or hornbeam in moist places, or with pine on drier situations. Where they are found thriving in pure woods, it may be safely asserted that

other crops of timber could be grown there with greater profit to the owner. This remark certainly applies to many parts of Scotland, as in Perthshire, where open woods of the birch are very often found getting little or no attention.

One drawback—perhaps, under certain circumstances far more serious than would at first appear—of having birch and aspen growing along with, or even in the vicinity of, Scots pine or larch, is that two forms of fungous disease not uncommon on these latter can only be reproduced by means of a change of generation with somewhat similar diseases on the leaves of the former. They thus form the 'hosts' upon whose leaves *Melampsora betulina* on birch, and *M. tremulæ* on aspen, effect their alternate generation with *Cæoma Laricis* on larch needles, or with *C. pinetorquum* on the Scots pine, sometimes causing canker on young pine shoots. This is an additional reason for cutting out young softwoods in crops of larch and pine, and for removing all birch and aspen growing near areas where conifers are soon to be regenerated.

The Lime (*Tilia europæa*) can hardly be called one of our forest trees, as it is practically confined

to parks and to the more ornamental portions of our woodlands. But as an ornamental tree it is well suited for the formation of avenues, and for parks and open spaces. These are, indeed, the proper positions for the lime. Grown in immediate proximity to a house it is no favourite of the gardener, who finds its beautiful foliage and the sweetness of its honeyed flowers in July not a full equivalent for the untidiness caused by the falling of the stipules and bracts, and the early shedding of the leaves. Producing wood lighter than that of any of our other broad-leaved kinds of trees, it would be well suited for making packing-cases, crates, and such like, were any quantity of it available; but the good land required for its best growth can be more profitably utilised by other kinds of woodland crops.

Horse-chestnut (*Æsculus Hippocastanum*) is of rapid growth, and is a fairly hardy tree. Its wood is soft and not durable, though in some parts of Britain it sells for as much as elm, and for more than beech or pine. It can be used for flooring, waggon bottoms, and turnery. Its best growth is attained in a sheltered position, as heavy winds are apt to break its spreading branches.

But it, too, is rather a tree for parks and avenues than a true denizen of the woodlands; and as it requires a good loamy soil for its best growth, hardwoods will usually prove more profitable for admixture among the timber crops.

The Willows (*Salix*) and Poplars (*Populus*) are, like alder and birch, very closely related to each other. Indeed, all the four genera are closely related and have many characteristics in common, for they are all light-demanding softwoods, and they all do well on moist or wet land. For this reason they were all known anciently as '*aquatic species*' of trees. There are now many kinds of willows and poplars grown in Britain, though originally there appears to have been only one indigenous kind of each, the Saugh, Sallow, Sally, or Goat Willow (*S. caprœa*), and the aspen (*P. tremula*). The willows and poplars are easily distinguished during their leafless winter condition, from the fact that the buds of the willow are enclosed by what appears to be one bract, while the poplar buds are enclosed within several bracts. Of both of these genera of the *Salicaceæ* family there are many species; and these branch off again into numerous, one is almost tempted to say in-

numerable, varieties. As regards willows, even in Evelyn's time there seems to have been rather a confusion between *Withies*, *Sallyes*, *Osiers*, and *Willows*. The first-named embraced the Crack or Redwood Willow (*S. fragilis*) and the White or Huntingdon Willow (*S. alba*), for he remarks that 'The *Withy* is a reasonable large *tree*, and fit to be planted on high banks; because they extend their roots deeper than either *Sallyes* or *Willows*. . . . There are two principal sorts of these *Withies*, the *hoary*, and the *red Withy*, which is the *Greek;* toughest, and fittest to *bind* while the twigs are flexible and tender.' The force of the word '*Greek*' here seems obscure, though if it were *crack* it would exactly correspond with our own term now. These two, together with the Russell or Bedford Willow (*S. Russelliana*), said to have originated from a cross between the two species, are the only tree-willows really deserving of cultivation, while the osiers or basket-willows may more conveniently be referred to when dealing with coppice woods. Our indigenous Saugh or Sallow (*S. capræa*), whose 'palms' render it a beautiful object in the early spring, is common in all low-lying moist tracts in woodlands

and along the margin of brooks, where its broad, oval leaves, generally twisted at their points, easily distinguish it from the other willows. Here it grows into a small tree, though along hillside streams it is more frequently a mere shrub. And in any case, it is not of much consequence to the forester. Where it occurs among coppice under standards, and in Britain it is frequently to be found there in moist patches, it should be removed in favour of some more profitable kind of tree.

Then, as for the other branch of the family, there are Black Poplars, Aspens, and Balsam Poplars; but the only kinds that in addition to the Common Aspen or Trembling Poplar, already treated of, can be considered as true trees of our woodlands are the Common Black Poplar (*P. nigra*) and the Canadian Poplar (*P. Canadensis*), belonging to the first group, and the Abele or White Poplar (*P. alba*) among the aspens.

On the whole the willows perhaps deserve more attention than the poplars, even though some of the latter are quicker in growth, because willow-timber is the superior in quality. Taken as a class the tree-willows show a decided tendency to run into branches, although, curiously enough, it

is just the opposite quality which makes osiers of special value. Light and rather tough willow wood is suitable not only for packing-cases and framework for veneering, but also for match-wood, and now for wood-pulp on the Continent, wherever any large supplies are available. The crack or redwood willow yields the best wood of all, suitable for flooring planks, railway trucks, and similar purposes, although the reddish cricket-bat wood of *S. alba var. cerulæa* is the kind which fetches the highest price.

The willows require a good, deep, and rather moist soil in order to prove a commercial success from the forester's point of view. But they have the great advantage of finding a congenial soil and situation along the sides of ponds or fringing streams and waterways, in places which are somewhat too moist for hardwoods. The crack and Bedford willows are rather apt to be broken by high winds, and all of them thrive best in sheltered positions, while the first-named often becomes 'stag-headed' and dry in the crown when grown in an uncongenial situation. With these exceptions the willows grow rapidly, soon attaining large dimensions on most soils that are

not too light and dry, though they of course thrive best and develop most energetically on deep, loamy, or sandy marshlands and riverine stretches. Here they form beautiful objects in the landscape, whether pollarded—especially the white willow, which pollards best—or allowed to grow up to their full maturity as trees. But there are many marshy places, overgrown with sedge and tussocks of coarse rank grass, offering but a poor pasturage at best, which might easily be profitably planted up. For such places, unless they can be drained to form better pasture or bear more profitable crops of timber, Evelyn's shrewd, common-sense advice still to a great extent holds good, that '*Sallyes* grow much faster, if they are planted within reach of water, or in a very *moorish* ground, or flat plain; and where the soil is, by reason of extraordinary moisture, unfit for *Arable*, or *Meadow;* for in these cases it is an extraordinary *improvement.* In a word, where *Birch*, and *Alder* will thrive.'

No forest trees are easier of propagation than willows. Layering is very simple when seedlings are already on the ground, while slips or cuttings, called '*trunchions*' in olden days, take root easily.

Such sets put out in spring are best made of the last year's wood, as they strike readily and grow rapidly, the object in view being thus attained more speedily than by means of seed. Hence sowing of tree-willows is not the usual method of forming or reproducing plantations. Root-suckers, like those so characteristic of aspens, are not thrown up by willows, though many of their stool-shoots look very much like true stoles. All three chief kinds of the tree-willows attain a very large size, ranging up to seventy feet in height, with a thickness of about three feet in diameter. Indeed, the Bedford often exceeds these dimensions, both as to height and girth. If the production of timber is the main object, and not beautification of the landscape, the trees should be planted in a mass, and kept close together to draw them up as straight poles. When once their main height has been attained they can be thinned out freely at short intervals, so that their strong natural demand for light and large growing-space may be duly met. This checking of premature branch formation is more particularly necessary in the case of the white willow, which will otherwise soon spread itself

out laterally. The wood of willows being soft and porous, the pruning of large branches is always attended with more than ordinary risk of fungous disease in the shape of rot occasioned by several kinds of *Polyporus;* and this remark also applies to the poplars.

The wood of the poplars is put to very much the same uses as that of willows, only it is not so tough, and is therefore not endowed with such good technical qualities as the latter. To make up for this, however, the poplars are even more rapid in growth. They yield good marketable timber at about forty to fifty years of age. The largest of them all, the Canadian poplar, often reaches a height of 100 to 130 feet, with a stem varying from 3 to 5 feet in diameter. The latter and the common black poplar are easily distinguishable from the white, waving, downy leaves, the silvery branches, and the smooth, light bark of the abele and the common aspen; while the black poplars, so called from their darker bark, which soon fissures longitudinally, are also easily distinguishable individually. The common black poplar has a thinner and more open crown of foliage, borne by branches forming rather a wide

angle with the stem; while the Canadian poplar is more thickly and heavily foliaged, the branches run upwards from the stem at a more acute angle, and their twigs curve in somewhat towards the stem. These distinctions as regards branch formation can of course be noticed most clearly during the leafless period of winter rest, but even during the spring and summer months the thicker foliage, the larger leaves, and their darker green colour serve to characterise the Canadian as differing from the common black poplar.

A good, deep, moist loamy soil and a sheltered situation are the conditions best suited for the cultivation of poplars, but none of the good kind will thrive to the best profit on dry, high-lying land. Given those favourable conditions, the Canadian poplar is the species whose cultivation is most likely to yield good and profitable returns. It is hardy, and shows itself more accommodating with regard to soil than either of the other two kinds; while it is extremely rapid in growth, produces wood of better quality than the common black poplar or the abele, and can, though essentially a light-demanding tree, be grown somewhat closer together than either of

these. These advantages can perhaps best be estimated when it is recollected that even the common black poplar often yields an average of two feet per tree per annum at thirty years of age when grown in a free position. Though this growth would, of course, be less in highwoods, yet the quality of the cleaner timber would be better for all kinds of technical purposes.

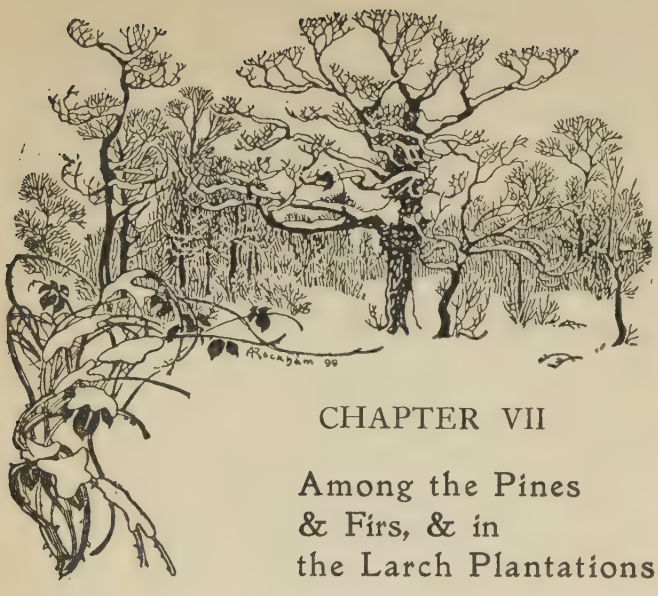
The white poplar is rather more exacting than either of the black poplars as to the kind of soil upon which it grows. It thrives best on loamy or sandy land; on anything like a stiff clay soil it is apt to become dry in the top. Though it also yields good timber at forty or fifty years of age, it is not so rapid in growth as the black poplars. Hence it is less suited than these for growth in highwoods; but, on the other hand, it is the best of all the poplars for coppice woods on suitable low-lying tracts, where it quickly produces a remunerative crop. As it is less affected than the black poplars by the smoke of towns, this form of crop may prove highly profitable wherever there is any demand for match-wood.

Like the common aspen, the abele throws up plentiful suckers, which indeed often render it

a great nuisance in pasturage and meadow land; but slips or cuttings do not strike so readily as in the case of the black poplars. The latter are easily propagated by sets of the young wood put out in spring, which do best if they are placed for a year in the nursery. Such yearling cuttings of the Canadian poplar often grow to a height of four feet in the nursery, which shows its power of establishing itself and its early rapidity in growth. If rank growth of weeds were not to be feared, the cuttings could of course be best and most cheaply put in position at once in spring when cut from the parent tree. In this matter we have not much to learn beyond what our ancestors knew. 'In moist and *boggy* places,' said shrewd John Evelyn, 'they will flourish wonderfully, so the ground be not *spewing;* but especially near the *Margins* and banks of *Rivers.*' And in adding precepts on their cultivation he advised how '*trunchions* of seven, or eight feet long, thrust two foot into the *earth*, when once *rootea*, may be cut at six inches above ground; and thus placed at a yard distant they will immediately furnish a kind of *Copse.* But in case you plant them of *rooted-trees*, or smaller *sets*, fix them not too *deep;* for though we bury the

Trunchions thus profound, yet is the *root* which they strike commonly but shallow.'

It is strange how the necessity for close planting, above clearly advocated, even for light-demanding trees, such as the '*poplar* and *abele* (which are all of them *hospitable* trees, for anything thrives under their *shades*),' should have been so completely lost sight of in British Forestry since the time of the Restoration. Probably very few of the plantations of any sort made during the last century have shown so many as the 4840 plants per acre recommended even for quick-growing poplars by Evelyn. And this is just one of the principal causes, along with injudicious and premature thinning, why all our woodland crops—hardwood, softwood, and coniferous—have neither been so remunerative in the past as they ought to have been, nor are so well qualified to yield a class of wood best supplying the requirements of the market in the present, as they should now be doing. But this fact must receive general recognition before it can be hoped that steps will be taken to remedy the defects arising therefrom, and to make Forestry more remunerative and better able to supply the wants of the British timber market in the future.



CHAPTER VII

Among the Pines & Firs, & in the Larch Plantations

AT one time, no doubt, a very considerable portion of the British Isles was covered by woodlands of Scots pine, our only indigenous conifer, still commonly called by its Anglo-Saxon name of *fuhr* or fir. The extent of these primeval woods and the method of their destruction, having already been referred to in the first two chapters, need not again be touched on. But in Holinshed's time there were still large tracts under pine, which have now mostly been cleared away. 'The firre, frankincense, and pine, we do not altogether want, especiallie the firre, whereof we

have some store in Chatleie moore in Darbishire, Shropshire, Andernesse, and a mosse neere Manchester, not far from Leicester's house: although that in time past not only all Lancastershire, but a great part of the coast betweene Chester and the Solwe were well stored.' At a later date much attention was given to the cultivation of Scots pine in many parts of England, both for its wild beauty as a woodland tree and for its value as a timber producer. In the New Forest, where pine is not indigenous, it was first introduced by the plantation of Ocknell Clump in 1776. After this it was largely planted on the poor sandy soils throughout several of the southern counties. But such plantations were sometimes loudly condemned. 'As to the first of these, the *Scotch Fir*,' Cobbett's opinion was that 'everybody in England knows too much about it, seeing that it now covers hundreds of thousands of acres that might have been covered by some valuable Pine, or by some other tree.'

Without considering this opinion critically, it may be safely asserted that at the present moment conifers, and the Scots pine by no means least of these, are certainly as well deserving of attention

as any other kinds of trees we have. First of all, of the enormous quantities of timber now being annually imported into Britain for constructive purposes more than nine-tenths are coniferous, nor are the demands likely to change in this respect, and a very great part of these imports could be quite easily and profitably grown as crops of timber on poor land now lying disused or heather-grown, and all but unproductive save for shooting purposes. Secondly, in comparison with broad-leaved trees, the conifers make but small demand on fertility of the soil, while even among conifers the pines, and particularly our native Scots pine, grow into fairly good woodland crops, where it would be hard to form plantations of other, more exacting kinds of trees. Hence a conifer crop of some sort, and sometimes, as on poor dry soils, specifically a crop of pine, is the only practical stepping-stone by which denuded and deteriorated hillsides or moors can be improved, by fall of the needles, so as later on to become suitable, if desired, for bearing a more exacting crop of broad-leaved trees when the conifers become mature and are marketable to the best advantage. And, finally, on the poorer

classes of soil coniferous crops of timber, judiciously formed and properly managed, are a decidedly remunerative way of utilising the land, as they often yield extremely good returns on the capital invested in them. Indeed, wherever purely financial considerations may govern Forestry, the greatest profit for land below the average in quality, and not infrequently also for some of the average classes of woodland soil, will usually be in coniferous crops treated with a rotation varying, according to circumstances, from about fifty or sixty up to seventy or eighty years. And this will be all the more apparent if plantations of timber have first to be formed on vacant land in place of being merely regenerated from crops already growing on the ground, *i.e.* as in new 'Afforestation' schemes.

There are, of course, drawbacks even to the cultivation of conifers, because they are more exposed to many serious kinds of damage than crops of broad-leaved trees. Grown in dense masses, pines and firs are liable to breakage by heavy snow, and to be thrown *en masse* by gales during wet weather —damage from which the deep-rooting deciduous larch of course suffers least of all the conifers.

Then they have each their own particular enemies in the shape of noxious beetles and moths, and of fungous diseases, which effect a foothold wherever the crops are either flagging in vegetative energy through unsuitable environment as to soil or situation, or have been subjected to injuries of any sort, as during hail-storms or high winds. These dangers can to a great extent be lessened by the judicious formation of mixed crops, yet they always exist in a greater or less degree. They must just be looked on as the unavoidable risks inherent to investments offering a good return from a poor class of land. In addition to judicious mixture of trees in forming woodland crops, the very best chance of immunity from insects lies in the protection of insectivorous wild birds. The forester's best friend in this respect is the starling; and everything possible should be done, by hanging up nesting-boxes and giving protection in other ways, to encourage this the most serviceable of birds to the farmer, the market-gardener, and the forester. The cuckoo is another extremely useful bird, while rooks, kestrels, buzzards, jays, and magpies do more good than harm. Even polecats, stoats, weasels,

and foxes have more virtues than vices so far as the woods are concerned; but here the gamekeeper and the sportsman unite to talk down the forester, and he must prudently retire before so strong a combination against him.

The Yew—anciently spelled *Vgh* (as in Holinshed), was perhaps the only English word that could ever be written without a vowel, for *v* and *u* were interchangeable. It is no longer necessary to grow Yew in woods, for as Evelyn says, 'Since the use of *Bows* is laid aside amongst us, the propagation of the *Eugh*-tree is likewise quite forborn.' It is now almost entirely relegated to ornamental groves, where many historical trees of great antiquity are to be found, and to churchyards, for which its sombre aspect and its vast longevity specially befit it. In gardens it forms, closely clipped, one of the most beautiful of hedges, though in parks the toxic effects of the leaves on horses and cattle render it most dangerous either as an ornamental tree or in a hedge. Its fine dark wood used to be made into tankards, yet even these were said to have had deleterious effects, although Evelyn, who will have none of this decrying of a tree which was once as valuable

to English bowmen as oak afterwards was to our seamen, explains that 'The *toxic* quality was certainly in the *liquor* which these good *Fellows* tippl'd out of those *bottles*, not in the *nature* of the *wood*.' But as there is no poison without its antidote, a brazen wedge driven into the body of the tankard counteracted this 'veninous quality' of yew wood.

The *Coniferæ* of importance to the forester in Britain are those comprised within the family of the *Abietineæ*. The most valuable genera are the Pines (*Pinus*), the Spruces (*Picea*), the Larches (*Larix*), and the Douglas Fir (*Pseudotsuga*); while the Silver Firs (*Abies*) are of more value than the Hemlocks (*Tsuga*) and Cedars (*Cedrus*). But of these latter kinds only the common Silver Fir (*A. pectinata*), the chief tree of the Black Forest and the Jura Mountains, can well be grown as a crop suitable merely for the warmer and milder portions of central and southern Britain or of Ireland. Of course, if placed in any unsuitable climatic environment silver fir has a weakly constitution, and it soon becomes liable to attacks of *Aphis* and to fungous diseases. This has been abundantly shown in the cool climate of the north of Scotland,

and it is precisely what one would have expected with regard to the cultivation of silver fir under climatic conditions differing so essentially from those of the inland continental localities to which it is indigenous. And very much the same must also be said about the spruce in Britain. Except when grown under very favourable conditions, silver fir timber—known as 'White Pine' from the paucity of resin ducts—ranks rather below that of spruce in general quality; and both of these are inferior to the heartwood of larch and Scots pine. The wood of the Douglas Fir or Red Pine of Oregon (*P. Douglasii*) produced in Scotland is now known to rank in quality between that of Scots pine and larch, and as its production of wood exceeds in annual average that of any other conifer grown in Britain, this very valuable tree seems to deserve special consideration and experimental cultivation in woods worked for profit —and especially the long-foliaged, dark-green or Pacific variety from the sea-coast provinces.

The rate of growth of Douglas fir is indeed remarkable. In 1887 evidence was given before the Parliamentary Committee on Forestry that on the Scone estate, in Perthshire, a plantation of

DOUGLAS FIR

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eight acres in extent, made in 1860 with four-year-old plants set at 12 × 12 feet and filled up with larch at 6 × 6 feet, gave a thinning of 620 poles of large size in the spring of 1887 as the Douglas fir outgrew the larch. These thinnings of 1887 were sold for £34, and the only expenditure incurred between 1887 and 1900 was £17 for pruning which might have been unnecessary but for the fact that the plantation was originally made at rather a wide distance. In 1900 this fine crop consisted of 1535 dominant trees, and 95 dominated stems about to be removed during the next few years. The average height of the dominant trees was then 75 feet, and the largest stems girthed 7 feet at 5 feet above the ground, though of course there was considerable diversity in the size of the trees. As the crop then stood on the ground the dominant trees were estimated to contain 25 cubic feet each, or 38,375 cubic feet worth 9d. a foot (£1439, 1s. 3d.), and the dominated trees 4½ cubic feet each, or 427½ cubic feet worth 8d. a foot (£14, 5s.), *i.e.* £1553, 6s. 3d. or £194 an acre for the total crop.

It still grows well. As the Earl of Mansfield has kindly informed me, this celebrated plantation

consisted in January 1908 of 1536 Douglas fir, or 192 trees to the acre, standing 15 feet apart on the average; and it was then estimated to contain 51,456 cubic feet of timber (under bark), or 6432 cubic feet per acre, thus showing an increment of over 1635 cubic feet per acre, or 204 cubic feet per annum on dominant stems, between 1900 and 1908. The largest tree was 93 feet high and contained over 117 cubic feet of timber; and the second largest was 99 feet high and contained over 105 cubic feet of timber. At 9d. a foot this forty-eight-year-old plantation was therefore in 1908 worth £241, 4s. per acre, and was increasing in value at the average rate of about £7, 13s. per acre and per annum, or over 3 per cent.

The four genera of abietinous conifers which seem most likely to form profitable woodland crops in Britain differ greatly among themselves as regards their natural requirements and their specific habits of growth. Larch (*L. europæa*), in particular, and also Scots pine (*P. sylvestris*) are distinctly light-demanding trees, while the two black pines, the Austrian (*P. Austriaca*) and the Corsican (*P. Laricio*), are less exacting in this respect. Douglas fir and spruces (see page 223),

on the other hand, are capable of bearing a fair amount of shade, and are therefore more capable of forming thicker woods on soil favourable to their growth. In some cases spruce perhaps seems also suitable for underplanting rather open woods of maturing larch or Scots pine where the amount of overshadowing is not oppressive, and particularly on good sandy soil, or near the sea-coast. But spruce is the best wood for pulp-making, and the Sitka species grows quickest.

The pines are characterised as a genus by their ability to thrive on poor land, so long as it is deep and loose enough to let their strong tap-roots sink well into the soil. The necessity for a free development of their deep root-system is characteristic of all four of the pines likely to be grown for profit in Britain—Scots, Austrian, Corsican, and Weymouth—Scots being least exacting of all these as to soil and climate. Though its finest development is perhaps attained on gravelly loam with a good permeable subsoil, it grows well upon deep, loose, sandy soil which once formed the bed of the ocean. Corsican pine also thrives well on much the same classes of land and can occasionally be profitably grown, either by

itself or along with Scots, in central and southern England, though it is less likely to thrive so vigorously in the colder climate of the north of Scotland. In warm localities it outgrows our indigenous pine both in height and girth; but its coarse timber is not as good as Scots, or is at any rate not held in equally high estimation by our wood-merchants and buyers. In mixed plantations on loamy and clayey soil in the Severn Valley it far outstrips Scots and can even outgrow the larch planted along with it. On the Earl of Selborne's estate of Blackmoor, in Hants, a few Coriscan mixed with Scots in the Wolmer plantation, formed on deep sandy soil belonging to the lower greensand formation, showed considerable superiority in rate of growth in a crop consisting mostly of Scots pine at the north end planted, in 1869, somewhat irregularly in lines at 4 to 6 feet apart. In 1899 it was just closing up well, but a tangle of bracken covered most of the ground. The growth in height varied from 30 to 45 feet, and the stems girthed up to 27 inches in maximo. Some Corsican pine among the Scots were quite outgrowing the latter: two at the edge of a green ride were about 50 feet high, and

girthed 29 and 33 inches respectively. They tend to run to a broad, branching crown unless grown in close canopy.

In addition to rapid growth, Corsican has other two decided advantages in being able to bear rather a greater degree of shade than Scots pine, which is impatient of overshadowing either from above or laterally, and in being, probably from its great resinousness, rather less attacked by rabbits than any other kind of conifer. But it is not shade-enduring enough for underplanting larch and Scots pine woods when once these have finished their growth in height and are being thinned freely to let the stems thicken rapidly for the market—though its comparative immunity from damage by ground-game would make successful underplanting and the formation of new woods, especially if feasible by sowing after adequate preparation of the soil, very much cheaper than regular planting. But, difficult to transplant, drought is very apt to kill it.

The Austrian pine has somewhat similar characteristics to the Corsican, but the growth of the latter in England appears often to be the more vigorous; and as its wood is of rather better

quality, Corsican seems to deserve the preference. On poor limy soil, however, Austrian may be of special service in re-wooding land which has been allowed to become exhausted and deteriorated through past mismanagement. In this respect it can sometimes be made to do good service in re-stocking hot southern or western slopes where thin woods of beech cannot be regenerated naturally—a task which has often to be faced in the beech tracts of southern England. Unless such land is not too stony for the plough, it can perhaps best be re-wooded by ploughing and broadcast sowing of beech mast, Austrian pine seed, and lucerne; otherwise the preparation is easiest in parallel strips running horizontally along the slope. The lucerne should not be harvested, but allowed to die and become manure for the beech and pine, which are to form the wood. The subsequent treatment of such a crop will of course depend on circumstances, but the first and main object is to get a stock of tree growth of any sort on the ground.

Larch, pine, and Douglas fir are the hardwoods among the conifers, their heartwood differing more distinctly in colour from the sapwood than

is the case in spruces or silver firs. The Scots pine timber imported from the Baltic and Scandinavia is classed as 'red pine,' while spruce wood is known as 'Baltic deals,' and silver fir as 'white pine.' Though not ranking equally with larch wood, pine timber is much better paid than spruce or silver fir, and it meets with a readier market, even though the wood is more apt to shrink. But spruce must rise in price as pulpwood under the conditions now obtaining.

Notwithstanding their somewhat greater capacity for bearing shade, the black pines may conveniently be classed along with Scots pine in treating of this as a woodland crop. Essentially a light-demanding tree, pine soon runs into branches unless grown in fairly close canopy. If planted wider than about four feet this natural tendency very soon shows itself. Later on, it is true, when close canopy is formed in the course of a few years, the branches are killed off unless the cover is opened up by injudicious thinning. Even when isolated, it shows a remarkable capacity for casting off its branches and exhibiting a clean bole picturesquely topped with a sparse crown of tufted foliage, most beautiful at sunset.

Pure woods of pine are usually found only on the poorer classes of dry soil, where pine is often the last resource of the forester; and in such unfavourable situations its growth is naturally not so vigorous or profitable as under more favourable circumstances. Here it may have to be felled at from about fifty to sixty years of age with a poor yield of about 3000 cubic feet per acre, while the better classes of pine soil will show considerably more than twice that stock, and at the same time make it profitable to delay the fall for other twenty years or more.

On land above the average in quality pine thrives well in admixture with other kinds of trees, needle-bearing or broad-leaved, so long as these are of somewhat slower growth, permitting it to have its crown free from overshadowing. Here it grows more vigorously, forms a better bole, and has a larger proportion of good red heartwood than if grown in pure crops, while it is less liable to be broken by snow or to suffer from attacks of noxious insects and fungous diseases. But on inferior classes of land it is often simply a case of 'Hobson's choice,' and the pine must go where a crop of other trees can either not be

produced, or is not likely to prove remunerative. Such land can often best be utilised by planting pine and keeping it in close canopy till the growth in height culminates and the natural demand for a larger growing-space seems to make itself imperatively felt. Then, usually between thirty and forty-five years of age, on the continent, they are thinned freely, yielding a good return in this way, and underplanted with whatever shade-bearing kind of tree seems to hold out the greatest promise of being profitable. This is doubly advantageous, because, under the close canopy of pine, the heavy fall of needles improves the land so much that its general quality and its productive capacity soon become far higher than they were at the time of planting. Thus close canopy is not only profitable for the growing crop, but it increases, *de facto*, the capital value of the ground planted. If, on the other hand, the natural manure with which the soil is thus enriched year after year by the dead needles be allowed to become dissipated through neglect of close cover, or of under-planting when the canopy becomes broken by advancing age and stronger demand for growing-space, the capital value thus increased artifici-

ally is gradually wasted, and decreases again without yielding any permanent advantage to the land-owner. This seems quite self-evident, when one comes to think the matter out. But the hereditary and customary British method of 'Arboriculture' is derived from the *Statute of Woods*, and the vast majority of our woodlands are game coverts and pleasure woods, the owners of which do not care to treat them merely, or mainly, on a commercial footing as crops of timber. Surely, however, if waste lands can be shown to be thus profitably productive of timber, our national 'shop-keeping' instincts, with which we have ever been credited by more economical continental countries, might also have full play even without interfering at all with the existing game preserves and ornamental woods in all parts of our Islands. Think of spruce woods for pulp!

On the better classes of pine soil natural regeneration is easy. It is the usual method in Britain; but on the continent it is thought that the damage done to the young seedlings by overshadowing is not compensated by the increased growth on the standard trees. Hence artificial regeneration is the rule in most localities

where there is a good demand for timber. Even without parent standard trees, a self-sown crop of seedlings soon springs up on blank spaces in immediate proximity to seed-bearing trees; but this can seldom indeed be relied on to form anything like a satisfactory and even-aged crop.

Planting has also, however, certain special dangers to face. When pine woods have been felled, replanting cannot safely take place just immediately after the clearing, unless the stumps and roots be stubbed up, as these form breeding-places for the pine weevil (*Hylobius abietis*), a very noxious beetle often committing great havoc among young woods in Scotland by gnawing off the bark during the months of May to August. This beetle of course does most damage where areas are cut in regular succession, when the fresh stumps, the places for breeding and larval residence, are in the immediate vicinity of the feeding-grounds, the young plantations, as the beetles hatch out in spring. This danger is minimised by allocating the annual falls so that the area to be planted each year shall be surrounded by falls which do not offer fresh stumps as brood-places. Like other conifers, the pine stems must

be barked to obviate danger from bark-beetles, otherwise soon increasing in myriads to become extremely destructive in the woods, and the timber should invariably be removed for sale or conversion as soon as possible after felling.

Perhaps the best distance for planting pine, and most other conifers, lies between $3\frac{1}{2}$ feet by $3\frac{1}{2}$ feet and $4\frac{1}{2}$ feet by $4\frac{1}{2}$ feet, plants of 2 to $2\frac{1}{2}$ feet in height being used. While not unduly expensive, this enables the crop to close well up quickly, and it can then yield good and early returns in the way of thinning when there is a favourable market. As among all other light-demanding timber crops, thinning of pines should extend to the removal of stems before they become so much dominated as to fall into an unhealthy condition, else they soon attract dangerous beetles.

Where the soil is light and sandy, sowing may sometimes be the cheapest way of forming pine woods for the first time, the land being ploughed and sown broadcast, or else prepared in strips and sown in rows. Where moor-pan forms an impervious subsoil it must be broken through by the steam-plough, because this, like hard, binding soil of any description, prevents the formation of

the pine's deep tap-root, affects its growth in height and its general vigour, and predisposes it to fungous disease. One of the most common forms of the latter, which attacks young pine plantations before they have succeeded in establishing themselves in the ground, is the 'leaf-shedding' caused by *Hysterium pinastri*. This disease is now very prevalent in England, and more especially during years of abnormal spring weather and summer warmth. The weakly state predisposing to attacks of this fungus is principally produced by drought, though it can also come from frost, as well as from active transpiration through the needles on bright sunny days in winter while the soil remains frost-bound and unable to furnish the rootlets with fresh supplies of water. But the reddening of the needles and the death of the plants over large areas often takes place from drought or frost alone, without the fungus. Before forming crops of pine, any very rank growth of heather or similar soil-covering should be cut and burned for the advantage of the young plants.

Of spruces, the only two likely to be of importance to the British forester are the Common or Norway Spruce (*P. excelsa*) and the Menzies or

Sitka Spruce (*P. Sitchensis*). The former is by far the better known and the more largely cultivated ; but the latter, a tree of giant dimensions like our other Californian immigrant, the Douglas fir, is perhaps more deserving of consideration as a profitable crop. Its timber is hard, firm, and durable, ranking between spruce and Douglas fir in general quality. On mild, fresh, loamy or sandy soil a good, wide-planted crop of Douglas fir and Menzies spruce, with larch sprinkled here and there having some advance in growth, might possibly prove one of the largest of all woodland crops that can be grown in Britain. The larch would probably have to be cut out at an early age, as unable to hold its own against the two quicker-growing trees, though not before it would be of marketable size ; and this method would diminish the existing risk of most poles being spoiled by canker. The full advantages of trees like Douglas fir or Menzies spruce, or any other non-indigenous conifer, can only be obtained, however, with cheap plants for raising a regular supply of the timber, because small lots of any unknown wood casually offered from time to time receive far less attention than if the supply were continuous.

The Common or Norway Spruce, one of the most profitable crops grown in mountainous tracts in central Germany north of the warmer region of the silver fir, does not thrive well in the mild climate of central and southern England. Here its general vigour is less than in its true home; and this immediately, and very noticeably, affects what is in a colder and more congenial climate one of its great characteristics as a timber crop—its capacity for bearing shade and protecting the soil either when forming pure woods or when growing along with larch and pine, as it counteracts the bad effects of their light crown of foliage and their inability to safeguard the soil against deterioration. This rather weakly state of growth here, this want of density and persistency in foliage, and the fact that hitherto its wood has fetched only about the half of what well-grown Scots pine can be sold for, makes Norway spruce a tree of little use in southern English woodlands. Its development and the quality of its wood are better if it be grown along with beech; but in England, oak, ash, sycamore, and any other hardwood would of course always deserve the preference in this respect, as being by far the more profitable kinds of

trees to be grown in association with beech. But in the cooler climate of Scotland and Ireland the growth of spruce is better than in the warm tracts of southern England; though there again the profit hitherto promised has never entitled it to much consideration *per se*. Despite the fact that close crops of spruce yield, from about 60 to 120 years of age, fully fifteen per cent. more wood than the Scots pine, yet the additional fact that in the north of Scotland, on the Novar estate in Ross-shire, some years ago, spruce only fetched 3d. a cubic foot against 3d. to 6d. for Scots pine, and 1s. to 1s. 2d. for larch, robbed its cultivation of an attraction it would certainly offer if Scottish 'Baltic deals' commanded a better market price.[1] Hence even in the north of Scotland or in Ireland,

[1] To be of any practical use such details must extend so far as to show the prices ruling (locally in 1900) for other kinds of timber :—for oak and ash, 1s. to 1s. 6d.; sycamore, 1s. to 5s.; elm and horse-chestnut, 1s.; beech, 6d. to 1s.; lime, 4d.: for timber growing in fairly accessible places. Local labour was paid at 17s. to 18s. a week for planting, and 18s. to 20s. for timber work, suitable bothies being provided to obviate loss of time in going to and from work.—There is probably no other commodity, except perhaps building stone, subject to such differences in local value as timber, owing to its weight and bulk. Hence the necessity for, and the profit of, improving communications in thickly-wooded districts. But spruce will rise in price now, for pulp, if large quantities be available.

with their more suitable climate, the cultivation of the Norway spruce has not hitherto seemed profitable on any large scale. But with the growing demand for wood-pulp this state of affairs is likely to end soon.

Its spreading superficial root-system specially fits it to be the tree of the mountains, with their shallow soil and rocky outcrops. So long as it grows in large compact masses, either by itself or along with other trees, its tangled network of roots enables it to offer considerable resistance to storms; but once the canopy is broken into freely, or the flank of the high forest is exposed to heavy wind, especially when the tree-tops are wet and heavy while the ground is sodden with rain, whole crops can easily be brought to the ground as windfall during heavy gales.

Like pine and larch, spruce has its special enemies in the shape of injurious insects and deadly fungous diseases, evils from which it is best protected by means of admixture with these or other trees. Where soil and climate favour its growth—a fresh or moist sandy loam, a cool situation, and rather a humid atmosphere—Norway spruce retains its foliage for about five to seven

years, so that, though the needles are small and short, they form a dense canopy overhead.

Unlike the Douglas fir and the Menzies spruce, the common spruce is less rapid in early growth than larch or pine, and this, coupled with its power of bearing shade, makes it, under favourable conditions, suitable for forming mixed woods in order to improve the growth of these more valuable trees, and to preserve the productive capacity of the soil. But in certain cases, however, somewhat similar advantages may perhaps —though experiments can alone safely determine this—be attainable with more profitable results by means of other trees like Douglas fir and Menzies spruce. Hence if the spruce seems soon likely to rank as one of the more remunerative kinds of timber crops in our British woodlands, this will be entirely through its value for pulping. Spruce woods are among the darkest, the most sombre, and the most depressing of woodlands, though the tree itself, when grown isolated, forms a remarkably beautiful addition to the pinetum or the park. Another great purpose the spruce can well serve—and in this respect it should be much more largely used than at present; it forms

one of the very best shelter-belts or wind-screens along the unprotected edges of woods and plantations exposed to the exhausting effects of winds. Along all such a couple of rows of the common spruce or the blue spruce (*P. pungens*) should be planted, *and never trimmed or lopped.*

Larch is one of the most interesting as well as one of the most profitable of all our naturalised trees. It was introduced into England in 1629, when it seems to have received no particular attention; but after its introduction into Scotland, either in 1725 or 1727, it was largely planted in many parts of the Island, though more especially in the Scottish highlands. The story is well known of how two seedling larches were sent in 1738 to the Duke of Athole at Dunkeld, together with some young orange trees and other exotics from Italy. Placed along with these in the hothouse, the young larch drooped and seemed to die, when they were thrown out on the rubbish heap. Recovering in the colder air they were planted in the lawn of the dower-house, where they both still flourished until the larger of them was struck by lightning in 1906, and dying from the effects of this was cut down in 1908. In

1904, when its age was estimated at 166 years, it was 100 feet high, girthed 15 feet 8 inches at 5 feet up, and contained 550 cubic feet of timber.

In Evelyn's time practically nothing was known about this tree, though of course he has a good word to say about 'the *Larch*, from whence that useful drogue *Agaric* is gather'd. I reade of *Beams* of no less than 120 foot in length made out of this goodly Tree, which is of so strange a composition that 'twill hardly burn, as *Cæsar* found in a *Castle* he beseig'd built of it; yet the *Coals* thereof were held far better then any other for the melting of *Iron*. That which now grows some where about *Chelnsford* in *Essex*, arriv'd to a flourishing, and ample *Tree*, does sufficiently reproach our negligence and want of industry.'

Under the encouragement of successive Dukes of Athole many millions of larches were planted on their Perthshire estates, and larch-planting became general throughout many parts of Britain during the nineteenth century. It was found to improve pasture in a remarkable degree, thus adding largely to the value of pasturage in mountain tracts, apart from the advantages accruing from the growth of its excellent, durable wood.

Unfortunately, however, it was often planted on soils and situations unsuitable to its true requirements, and unfavourable for sound, vigorous growth. Indigenous to an alpine climate that changes very suddenly from winter into early summer, and back again from late summer into the winter state of rest, it had to encounter the different conditions of a well-marked spring and autumn. But these conditions were, unfortunately, just those which favoured the growth and spread of a very destructive form of cankerous disease of the stem peculiar to the larch, due to a pinkish-grey and orange fungus, *Peziza Willkommii*. This parasite occurs in the Alps also, it is true; but the sudden change from winter to summer and then back again to winter, combined with the greater dryness of the climate, prevents the *Peziza* from there ripening and scattering its myriad spores, while at the same time it better enables the larch to withstand attacks. The milder and more humid climate of Britain, the formation of large pure plantations, and perhaps also changes in the vegetative power and physiological habit as compared with the natural vigour of larch in its alpine home, in consequence of being

planted on soils and in situations not really suitable for it, have enabled this disease to obtain a very firm footing in Britain, and to become an epidemic scourge to the larch-grower. Many plantations become so badly affected with canker as to be quite spoiled for the production of valuable timber; and there is no hope of now stamping out the disease. The best thing that can be done is to exercise care in the selection of localities for growing it, in which respect a northern aspect most resembles the alpine climate; to grow it only on a suitable soil, such as good, deep, fresh lime or loam and the better classes of sand; and to raise it in mixed crops rather than in pure plantations. Neither tenacious clay, nor a binding lime, nor poor soil, nor land that can be classed between moist and wet, is favourable to its good growth and healthy development. Under any adverse circumstances, but especially when growing on unsuitable soil or on a hot exposure without depth enough to accommodate its deep tap-root properly, its natural vigour is diminished. It is then most apt to be attacked by the larch aphis (*Chermes laricis*) and the mining moth (*Coleophora laricella*), the injuries made by

which form wound-spots soon infected by the canker-producing *Peziza* fungus.

Larch develops a very strong tap-root, hence depth of soil is essential for good growth. And it is the most light-demanding of all our forest trees, hence the free enjoyment of light and air are essential requisites for its continuous thriving even when its main growth in height has been completed. Although pure plantations may seem to thrive well, growing larch in this manner is not the way of producing the largest and the most valuable stems, while it certainly very much increases the danger from insects and canker. The best dimensions of larch and the finest quality of timber are produced in admixture with beech on limy soil. This, or planting here and there as a standard in copsewoods, or growing along with pines and firs on the better classes of land placed under conifer crops, must be treatment better suited to the larch than growth in pure woods. Seeing that Weymouth pine also grows well on a limy soil, an admixture of larch (2½ to 3 feet high) and Weymouth pine (about 2 feet high) should often do well at 4 feet apart—care being duly taken to secure some solid advan-

tage for the more rapid growth of the larch in height, to avoid its being dominated by the pine. Grown along with oak and ash as standards over coppice larch should yield a very profitable return, while a little expenditure in pruning off any unnecessary lower branches overshadowing the coppice, and tarring the wound-surfaces, would be well spent in the improvement of the bole.

Where grown in pure plantations, larch woods soon thin themselves and get overrun with weeds. A pure larch wood of about thirty to forty years of age has little above half the density of a good crop of Scots pine, yet even the latter cannot protect the soil for itself. Between the twentieth and thirtieth year the necessity for a free growing-space makes itself unmistakably noticeable in larch plantations; and after that underplanting is necessary, else the soil soon gets weed-grown, then deteriorates and gradually loses in capital value. There is of course always a great inducement to plant pure plantations of larch, as they soon yield thinnings of marketable value even in spite of the canker. And when the demand for such small poles is good, as in hop-growing districts,

pure crops can prove highly remunerative. The following example, furnished by an estate-agent on the Chiltern Hills, may show how profitable larch can be, even when grown on poor land, in southern England. 'Larch plantations on the chalk subsoil, overlaid with a good cap of flinty clay, have done remarkably well, and are very profitable to grow. As an instance, a portion of a plantation was recently cut hand-smooth, and consisted of about 220 matured trees per acre, which realised as many pounds. The original number was about 2700, and from the time that the poles were large enough to use for cutting through the centre for rails, &c., this plantation has always yielded its annual quota to the estate account. The age of the trees is known to be about seventy years, one man having been found who assisted in planting the original stock.'

This plantation was apparently formed at about 4 feet by 4 feet. How interesting it would be if data were available to enable us to compare these results with those for other conditions. If the plants had been put at 3 feet by 3 feet, or 4840 per acre, thinned sparingly from time to time

during their most vigorous period of growth in height, and then more freely thinned and underplanted when their long boles were fully developed, the monetary returns might even have been more satisfactory. The returns from thinning would have been earlier and more frequent, and the mature crop might have been larger and more valuable; and perhaps underplanting would have been another source of income, and not merely an investment unprofitable in itself save for the benefit accruing to the older overwood. Were all the requisite data available, such inquiries would be simply a matter of calculation; but they are wanting as yet for such a specific purpose with regard to our British woodlands.

When planted among other young crops larch will generally maintain for a considerable time any advantage in height given to it, and its light shade will not interfere to any excessive extent with their growth. Whether, later on, the larch is to be retained as part of the ultimate crop, or removed if caught up and pressed by the other trees, is a question which can only be settled when it arises, after consideration of the local market prices for the timber in question.

As a standard in copse, along with oak and ash, it can well hold out a rotation of 100 to 120 years, thus producing timber of specially valuable dimensions. One seldom sees it in hedges, and yet in sheltered localities it could be better grown thus, especially with pruning of the lower branches, than many of the standard trees which have been favoured there in Britain from time immemorial.

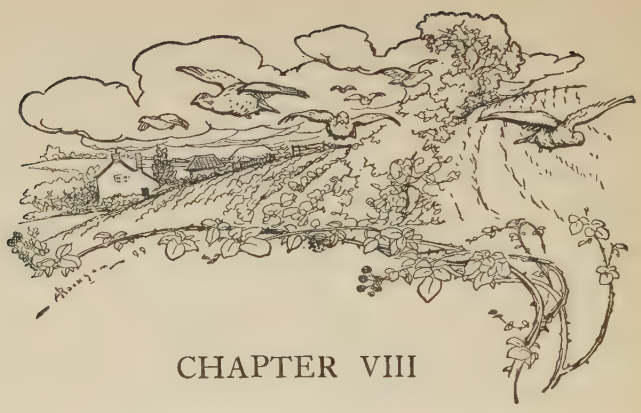
Owing to its impatience of shade, even of the lightest description by parent standards, artificial regeneration of larch is the rule. Everywhere, in Britain, this has been almost entirely by means of planting; for sowing, either broadcast after ploughing the whole land, or else in drills if the land is only partially prepared in strips for the reception of the seed, seldom gives a satisfactory crop of seedlings, while the land is very apt to become thickly overgrown with a very rank growth of weeds, making further planting operations difficult and expensive. It is therefore far better to plant at once, at whatever distance and with whatever size of plants the given conditions seem to indicate as being best.

To try and obviate the disappointment and

loss caused by canker, experiments have been largely made in Britain with the Japanese larch (*L. leptolepis*, so called from the 'thin scales' on its cones). This is a very hardy species, and even more rapid in early growth, though less useful as timber. But it is yet too soon to hazard any definite opinion as to its suitability for replacing the European species, which has so often proved itself very profitable despite the constant insidious attacks of this fell disease.

Like the birch, the most light-demanding of broad-leaved trees as the larch is among conifers, it is one of the hardiest and most rapid growers among our woodland trees, hence it can well be utilised, wherever necessary, as a nurse for less hardy species in frost-holes. But then it should be cut out when it has served its purpose, although there will often be the temptation to let it stand just a year or two more to grow a bit larger before being cut out—yet that little advantage may be dearly bought by interference with the growth of what is meant to be the permanent crop. A tree here and there, however, should always add something to the value of the crop, so long as this retention of larch

is not done on so large a scale as to induce bad attacks of the cankerous fungous disease, the wind-borne spores of which are now almost everywhere scattered throughout the length and breadth of our British Isles. But even the Japanese larch is by no means immune from this fell disease, although there can be no doubt that it is as yet not so liable to be attacked by the fungus as the European species which yields the better timber. For interplanting among coppice or on very weedy ground the Japanese larch has the great advantage of growing very rapidly when young—although later on it does not maintain this quicker rate of growth than the European larch.



CHAPTER VIII

Hedgerow Trees & Hedges

THE hedges and hedgerow trees are among the fairest possessions of our beautiful country. They form the chief features of English landscape, and give to it a beauty unknown on the Continent of Europe, where field joins field in dreary monotony without hedge or fence. It has, no doubt, ever been so. Trees were convenient to mark off different holdings, and they were connected by live fences grown for shelter; so hedges and hedgerow trees have always been, along with scattered remnants and other patches of woodland, among the great features of rural England. In the sixteenth century Holinshed tells us how, 'in the woodland countries there is

almost no hedge that hath not some store of the greatest sort (of trees), beside infinit numbers of hedgerows . . . that are mainteined of purpose for the building and provision of such owners as doo possesse the same.'

Oak had then always the preference, though nowadays elm is certainly the tree most commonly to be found along country lanes and among the hedges, where it throws up abundant suckers, giving free choice for standards at convenient distances—at any rate in the warmer parts.

From a purely business point of view there can be no doubt that the growth of hedgerow trees is in direct opposition to the highest farming of the land. All standard trees interfere, some more, some less, with the growth of crops on arable land, and even the shelter given to cattle and sheep on pasture lands would be much more effective if narrow shelter-belts were planted than it can possibly be by means of standard trees scattered among the hedgerows. That hedgerow timber diminishes the yield of arable land is a factor which now receives a certain amount of practical consideration. In Oxfordshire, for example, farm leases used to

have a clause, in favour of the landlord, that the hedgerows should contain not less than a certain number of standard trees; but one of the effects of the fall in the agricultural value of land has been that between the seventies and eighties a change of this clause was made, in favour of the farmer this time, that not more than a certain number of trees may be retained as hedgerow timber. This luxury of the great landowners is freely enjoyed by the nation at large; but it is not economical or consistent with the best utilisation of arable or pasture land. To forestall loud censure for this opinion, subversive of the existing order of things, I would seek shelter under so well-known an authority on Agriculture as the editor of the last edition of Stephen's *Book of the Farm*, with the remark that he likewise fortifies his opinion by quoting, with approval, from Lord Kames, that 'To plant trees in the line of a hedge, or within a few feet of it, ought to be absolutely prohibited as a pernicious practice.'

It would certainly be a national calamity for the lover of beautiful scenery if agricultural improvement could ever go so far as to sweep

all the hedgerow timber from the face of rural England; but this is never likely to be the case. What might however, not altogether without advantage, take place is that more consideration should be given to the choice of the standard trees to be grown there. True, it is indeed impossible to name kinds having specific advantages as hedgerow trees, for all of them damage the crop to some extent; hence the only thing remaining is to see which are the best in the way of providing shelter, and least objectionable as doing least harm to pasturage or to the cereal and root crops grown in the fields. To some extent damage may be obviated by pruning, but only within narrow limits.

If shelter be wanted, elm, maple, and sycamore have the advantage of coming into leaf early in spring. But then the elm is both a greedy robber of the soil-nutrients meant for the field-crops and a hindrance to the ploughshare (see page 150), while the heavy foliage and the spreading branches of the other two damage the crops greatly by overshadow and drip. Heavily-foliaged trees like beech, hornbeam, and horse-chestnut are quite out of place in a hedge, as their drip

destroys it and causes blanks. The lime, too, has the disadvantages of a spreading habit and a thick shade. Ash does comparatively little damage by overshadowing, but then it is as greedy and objectionable as the elm. Old writers on rural economy recommended this as the best means of growing oak for the navy, and it certainly was one of the best ways of growing crooked timber; but the conditions as to timber supplies and growing of corn are vastly different now from what they were then, and the spreading habit of oak renders it now unsuitable for growth in the hedgerows. Yet it still is, next to elm, the standard most often seen in country lanes and along the edge of the fields. None of the 'aquatic trees' are naturally suited for occupying such a position, and Heaven defend England from rigid rows of tall Lombardy poplars, which, like Noah's Ark trees, line the roadways of rural France and Germany. Most of our broad-leaved trees, and all of the best of them, are objectionable except on the score of beauty, from which point of view oak, elm, and ash, the somewhat thinly-foliaged trees, reign supreme; for those of denser foliage soon acquire a formal,

solid appearance, less graceful in outline and in general æsthetic effect.

And what then remains for consideration as standards in our hedgerows? The only other large trees worth thinking of are the Acacia or Locust tree (*Robinia pseudacacia*) and the larch. But the larch would have to be so cleared of its lower branches that it would be hardly what one would call a beautiful object in the hedgerows; while the acacia, yielding excellent tough wood, throws shallow roots around, is spreading in its growth, and is apt to have its branches torn off by heavy winds. It is more a tree for planting on deeply sandy soil or on light pasture land, where the locust pods can be enjoyed by the cattle.

So, after all, guided by the principle above laid down, the conclusion forced upon one seems to be that the least objectionable trees in hedgerows are the minor kinds, such as mountain ash, laburnum, wild cherry, field maple, service tree, and such like. And, fortunately, these are among the most beautiful of our trees, either in the gorgeousness of their spring flowers, or in the full, rich, mellow colouring of their autumn

foliage. Who shall affirm that the spring beauty of wild cherry or laburnum surpasses the autumnal glory and richness of field maple, rowan, and service tree, or the reverse? Of these a larger store than of big trees can be reserved in the hedgerows without prejudicing the growth of the crops so much; and some of them yield useful small timber for ordinary estate purposes. It is, indeed, very much open to question if the selection of hedgerow trees has hitherto received anything like the attention it deserves; yet it is often not one of the least important points in the rural economy of certain parts of England. In some places even good fruit trees might be grown there with profit, like the apples, pears, and plums planted along public roads in many parts of Germany, which not only cover the cost of maintaining the highway, but also yield a good annual surplus.

With regard to the live hedges themselves, they are subject to precisely the same law as the woodlands,—highwoods, copses, and coppice-woods,—the law of demand for light and of capacity for bearing shade. The best hedges are formed by trees and shrubs having the thickest

foliage and the greatest power of enduring shade, along with a good reproductive power, such as beech, hornbeam, yew, spruce, silver fir, holly, hawthorn, hazel, and in a minor degree blackthorn, maple, wild cherry, and the like. But the advantage, for general use, rests with the minor trees and shrubs, and particularly with those that are of a thorny nature, fitting them also as fences against cattle. One drawback to hedges of trees like spruce is that they require constant trimming to prevent them throwing up long leading shoots. As regards all hedges, their thickness and their vigour in growth must of course be more or less impaired by the retention of standards. The heavier the overshadowing and drip from these, and the nearer their crowns to the hedge, the more must be the damage done to this. Too many standards, or neglect to prune all low branches and to remove the trees before the hedges are badly injured, must often cause far more loss than is counterbalanced by the profit the trees bring in to account; because in such cases, as in others, the work of destruction is often rapid, while that of reconstruction is slow and costly.

Beech makes a first-rate hedge, because the dead leaves remain persistent, as in young plantations, when the older woods shed their russet foliage in October. Hornbeam is also very good, being surpassed only by hawthorn and beech for general hedging purposes. Excellent hedges can also be made of yew, holly, spruce, silver fir, privet, Portugal laurel, boxwood, myrtle, and juniper; but all of these are really only suitable for gardens and ornamental grounds, and not for the rough wear and tear of field hedges. But beware of forming a yew hedge wherever horses and cattle may at any time chance to graze near it. Ever and anon the newspapers exhibit the views held, or the discoveries just made by individuals, as to the toxic effects or the harmlessness of yew. Long ago that point was fairly settled as regards horses and cattle, though sheep can eat of yew with impunity. There is no more unprejudiced evidence than that of gentle Gilbert White, as given in his *Observations on Vegetables*, that 'A horse tied to a yew-hedge, or to a faggot-stack of dead yew, shall be found dead before the owner can be aware that any danger is at hand; and the writer has been several times a sorrowful witness

to losses of this kind among his friends; and in the island of Ely had once the mortification to see nine young steers or bullocks of his own all lying dead in a heap from browsing a little on a hedge of yew in an old garden, into which they had broken in snowy weather. . . . True it is that yew trees stand for twenty years or more in a field, and no bad consequences ensue; but at some time or other cattle, either from wantonness when full, or from hunger when empty (from both which circumstances we have seen them perish), will be meddling to their certain destruction.' So there is nothing new in that.

Evelyn admired the holly, and who does not? He went into positive raptures about it. 'But, above all the natural *Greens* which enrich our *home-born* store, there is none certainly to be compar'd to the *Holly;* insomuch as I have often wonder'd at our *Curiosity* after *forreign* Plants, and expensive *difficulties*, to the neglect of the *culture* of this *vulgar*, but *incomparable* Tree; whether we will propagate it for *Use*, or *Defence;* or for sight and ornament.

'Is there under *heaven* a more glorious and refreshing object of the kind, than an impreg-

nable *Hedge* of *one hundred* and *sixty foot* in *length*, *seven* foot *high*, and *five* in *diameter*, which I can shew in my poor *Gardens* at any time of the year, glitt'ring with its arm'd and vernish'd *leaves?* the taller *Standards* at orderly distances blushing with their natural *Corall:* It mocks at the rudest assaults of the *Weather*, *Beasts*, or *Hedge-breaker*. . . . *Et illum nemo impune lacessit.*

'True it is, that *time* must bring this tree to perfection; it does so to all things else, *et posteritate pangimus.* But what if a little *culture* about the *Roots* (not *dunging* which it abhorres) and frequent stirring of the *mould* doubles its growth? We stay *even years* for a tolerable *Quick*, it is worth staying it *thrice* for *this*, which has no *Competitor.*' And, of course, every one will admit that there is much truth in this.

Of all kinds of trees or shrubs, however, the Hawthorn, May, or Quick (*Cratægus Oxyacantha*) makes the best live hedge for fields. Taken for all in all, no other plant is so suitable. Growing easily in a great variety of soil, it also exhibits a considerable degree of density, and can, properly maintained, well resist pressure; while its thorny branches keep cattle and sheep from trying to

force their way through it. Limy and marly soil suits it best, yet it grows well on any sort of dry land capable of being used agriculturally. On high situations with a light soil, however, the hedge can occasionally be much improved by mixing beech, or hornbeam (except on chalky land), to the extent of about one-third along with the thorn, as apparently even here the soil-improving qualities of the dead beech-leaves, rich in potash, are of benefit to the quick. But the advantages of mixed crops, a sound principle for most kinds of woodlands, do not extend to hedges. The use of the shade-bearing beech and hornbeam is, however, often necessary to fill gaps in thorn hedges caused by rank growth of weeds. One decided drawback to this admixture of beech and hornbeam is that cattle soon find out that these are not thorny, and then they often force their way through, undeterred by any fear of being torn or pricked. To make the hedge more of a fence, sweetbriar is often mixed with hawthorn; but it soon spreads and interferes with the latter. Wherever the thorn thrives, as on a heavy loam, it is certainly best to keep it pure and clean. On very light land, however, like most sands, or

gravel, it is apt to die suddenly; and in such places beech is the best hedge for farm purposes and protection. On a poor soil, and especially within the influence of the sea-breeze, the Myrobella or Cherry-plum (*Prunus Myrobalana*) seems worthy of encouragement as a hedge-plant, for it stands cutting almost as well as the hawthorn.

Less suitable species for hedging purposes are the field maple, dogwood, spindle tree, elm, hazel, elder, blackthorn, buckthorn, wild cherry, crab apple, barberry, and the like, which add greatly to the beauty of the country-side, though often at the cost of giving a ready excuse for the wholesale use of barbed wire, that curse of many hunting counties. Rural England would certainly be much less charming than it is were the cold north-east winds of the 'blackthorn winter' to blow without bringing the white blossoms of the sloe in March and paving the way for the flowering of the wild cherry and the crab apple. And autumn would be less lovely without the rich colouring of the leaves of the field maple, dogwood, and other gorgeously foliaged shrubs. But they are not good for the hedges, either considered as fences or as a shelter against wind. And still

less in their proper place are the chiefest glory of English hedgerows and lane-sides, the wild roses, blackberries and raspberries, the trailing honeysuckle or woodbine, the wild clematis, beautiful alike as the 'traveller's joy' of summer or the 'old man's beard' of winter, and all the many lovely wild plants that make our Island fairer than any other country, and pleasanter to dwell in, despite certain drawbacks in the matter of climate. But, alas! where this wealth of beauty is greatest, the hedges are usually in the most neglected and least satisfactory condition. Clean, well-kept hedgerows should show but a small proportion of 'weeds' of this sort, beautiful though they be in themselves. Weeds, however, are merely plants out of place; and the hedgerows just happen not to be the proper place for such plants as ought to be cultivated in a wild garden, or 'wilderness' as it used to be called.

In many parts of Scotland and Ireland dry-stone dykes are erected, or the common whin or furze is used as a hedge. But furze is not really an economical hedge, and in most cases beech, or even birch at high altitudes, would

probably be much preferable and cheaper in the end, though costing more to form, because a whin-fence is apt to be damaged by severe frost, and rabbits soon swarm along the hedge-row and make it open and of little use for its purpose.

The shape of the hedge is a matter worthy of more consideration than it often receives. Thick, square-shaped, and narrow upright hedges can be very conveniently grown in gardens, home-parks, and pleasure-grounds; but with regard to field-hedges the form must necessarily be one by which effective protection can be secured with least outlay for maintenance, and this is best attained by a shape varying from a sharp-pointed triangle to something of a paraboloid form. In high situations, where heavy falls of snow may lie for a long time on the hedges, the advantage lies in having rather a narrow-based, pointedly wedge-shaped outline as the contour of a section; whereas in the milder and more sheltered agricultural districts broad bulging sides, meeting at a bluntish apex, make a finer hedge and a better fence against cattle. The drawbacks against these advantages are the wider growing-space its greater

breadth requires, and the larger amount of attention it demands to maintain it and keep it close and trim, so as to be thoroughly effective.

Just as it is infinitely preferable and cheaper in the long run to keep farm buildings and outhouses in good repair, rather than have considerable outlay forced upon one from time to time, so also is it in every way economical to see that all hedges around fields or plantations are kept in proper order. In not a few parts of Britain the neglect, or even the disloyalty, of tenants in this matter is only equalled by what at first thought might seem the apathy of estate agents and landowners. This, however, is merely one phase of the agricultural depression that began between the seventies and eighties. Tenants will naturally endeavour to save as much as they can on the tending and maintenance of hedges, while agents and landowners are often only too glad to have tenants at all on the farms to insist too stringently on the letter of the lease in this respect. But there can be no doubt that, while the maintenance of the hedges in clean and good condition is easy and not unduly expensive, the repair of neglected hedgerows is truly 'spend-

thrift,' costly alike as to money and time. Good, well-kept hedges, properly cleaned and pruned, can be maintained on well-managed estates in different parts of the country for about a farthing a yard per annum, or 36s. 8d. per mile of hedge-row, while neglected hedges can easily run into ten times that amount before they are brought back again into really proper, serviceable condition. Regular cutting and cleaning are essential for the proper maintenance of live hedges. Unless the growth of grass and of other weeds is checked, which always find their way there through the seeds being carried by birds or borne by wind, these soon begin to interfere with the lower branches of the hedge, and affect its utility. Really well-kept hedges should not only be trimmed either in late autumn or early spring, but they should also be cleaned in June, and, where necessary, again in August. Autumn trimming minimises danger from snow, while spring pruning makes the country more beautiful in winter, and leaves a kindly store of food in the shape of hips, haws, and other berries and fruits for the farmers' friends among the birds. And the earlier the hedger does his work with

switch and bill before the rise and flow of the sap, the better for the hedge.

During the spring and the summer cleaning of the hedgerows all herbaceous and woody plants should be removed. Everything likely to interfere with the growth and compactness of the hedge, down to the very ground, should be cut away in the endeavour to keep the fence as clean and effective as possible. Of course, taking things as one actually finds them, this high standard can never be reached in practice, though it should be aimed at so far as is feasible. A special order should, however, be given to the hedger about the cutting out of the most noxious class of weeds, such as barberry. This not only finds its way into hedges, but is even regularly used for hedging in some parts, as, for instance, in some of the Perthshire valleys. Yet it is a standing danger to wheat-crops by reason of being the host upon whose leaves the smut or wheat-rust of *Puccinia graminis* has its change of generation before it can again reproduce itself. In the early nineties, all around Pitlochry one could see hedges having a free growth of fungus-infected barberry and strengthened with slabs of

cankered larch, that might have formed an object-lesson both to the farmer and to the forester.

Thin hedges may best be thickened, and gaps be filled, by planting. This can preferably be done either in November or else late in February, but in the latter case it is well to prepare the soil beforehand in the autumn. Other methods are also often adopted, though where hedges are well trimmed annually and properly cleaned, little or no outlay should be necessary for filling blanks. In some parts of the country the common practice is to strengthen weak, thin fences, trimmed merely every few years in place of annually, by only partially cutting through the poles without completely severing them from the stool, and interweaving these poles, when trimmed, with the scrubby growth of the fence. This rather slovenly, stop-gap sort of system is one that is very largely practised in Herefordshire, where it is known as '*pletching*.' A very similar word, 'plashing,' still used in Hampshire, is the old term for layering; but 'pletching' or interweaving is of interest as an example of a word still in use although recorded as obsolete in Johnson's Dictionary. The many old woodland terms which

exist are well worth preserving as a heritage not to be despised. Indeed, one great fault of nearly all of the recent contributions to what is called 'scientific' Forestry, in contradistinction to the British arboricultural methods hitherto prevailing, is that French and German terms have often, quite unnecessarily, been largely introduced into books and practical work. We have excellent, well-defined, good old English and Scottish terms, such as 'fall,' 'curfe,' 'highwoods,' 'copse,' 'stores,' 'heirs,' and the like, which are far better than the expressions sought to be introduced. The latter should certainly be weeded out in favour of our own stock of words handed down to us from olden times. It will be no hard task to graft on simple words to express operations, methods, and conditions new to British Forestry without discarding our old expressive terms in favour of strange French words, or ponderous and even still stranger Teutonisms.

CHAPTER IX

Highwoods, Copses, & Coppicewoods

THE ancient English Forest Charters and the Statutes only recognise two classes of woodland crops—the overwood or high timber (*Saltus* or *Boscus*) and the covert or underwood (*Subboscus*). The *Boscus* included trees stored under the Statute of Woods (1543); the *Subboscus* comprised both coppice (*Sylva cædua*) and such part of the overwood as might legally be felled in rotation.

Whether the woodland crops be now managed as regular highwoods for the production of timber of large size, or as copses, or else as pure or mixed coppices, they are all, when treated economically with the main object of producing an

income, subject to the same principles as to management. Each of these three possible systems of treating woodland crops represents an investment of capital with regard to the growing stock, in addition to the capital value of the land; but there are, of course, very wide variations between the capital required, say, for osier-holts maturing in from three to five years and then producing a crop capable of being harvested annually, and high-woods of conifers or of oak and other hard-woods, which only attain their full financial maturity at ages varying, say, from about fifty to considerably over a hundred years of age. In this latter case it must always happen that the capital represented by the standing crops of timber will greatly exceed, in actual monetary worth, the freehold value of the land. But, under all the three systems of forest management there is — and, from the very nature of the investment, it is self-evident that there must be — a certain very close relation between the capital in wood-crops which ought to be on the ground, so as to utilise and at the same time safeguard the productiveness of

the land in the most thorough manner possible, and the system of cropping selected, whether highwood, copse, or coppice. If the crops are too thin, whether this be caused either by wide planting or by premature thinnings, as is not seldom the case throughout Britain, then the productiveness of the soil is not utilised to its full extent—which, of course, means that the income derived is not so large as it might be—while there must also exist the danger that the soil is not being so well protected against the deteriorating effects of sun and wind as would otherwise be the case with crops forming closer cover. And these two factors mutually act and re-act on each other. On the other hand, if the crops stand too thick—that is to say, if adequate thinning be neglected—then the crops are exposed to the danger of becoming weakly in growth and very injuriously affected as to their ultimate value when mature and ready for the fall. In this latter case, the greater density of the crop adds nothing appreciable to the capital value of the land ; on the contrary, it rather depreciates it if judged by the practical standard of its productiveness in growing woodland crops for the market.

In each system of management there is therefore a certain amount of capital which can be invested with profit in the growing stock, and which must, in fact, be invested in order to obtain the best returns from the land. And it is one of the main objects of Forestry to indicate theoretically, as well as to arrange practically, how the necessary capital in wood can best be adjusted and distributed over the woodland area, in order to produce the most advantageous returns in the shape of a regularly sustained annual yield. While the market available for woodland produce must of course be one of the chief factors in determining the kinds of crops to be grown and the system of management to be accorded to them, yet the soil, the situation, and the local climate generally are all matters of importance for financial success; and these have frequently in the past received less attention than they require. Hence the result has often been that the growth of the crops has been unsuccessful. Anticipations not having been realised, many landowners have thought that Forestry cannot pay in Britain. But this is due to the bad effects of these investments,

often decidedly speculative in the case of larch, not being attributed to their true causes—to want of knowledge of the very simple scientific and economic principles upon which the art of Forestry is based.

The main object of commercial Forestry is to obtain the largest and most profitable returns from the land in the shape of a regular yield sustained annually. Hence, as regards the amount of capital to be invested in the growing stock of woodland crops, the principle is that (subject, of course, to yielding produce of the dimensions required for the available market) it shall be neither more nor less than is requisite to produce the best regular income from the land under wood. With regard to coppices, the capital which can most suitably be arranged for is that which permits of the fall being made in the shortest possible rotation without exposing the soil unnecessarily to deterioration from sun and wind through being repeatedly laid bare by too frequent harvesting of the crop. In highwoods, however, the capital locked up in the growing stock, which is much larger than that required for copse or for coppice, will be

retained in the woods so long as reasonable calculations (for which the rate of growth shown by the trees themselves and the local market prices afford the only practical data) indicate that the woods are still in full vigour, and that the increment being annually made (judged by its equivalent as estimated in money) is not already beginning to diminish.

Experience shows that in highwoods the longer periods of rotation prove advantageous on the better classes of land, while in copse and in coppices the shortest periods are only permissible on good soil and in favourable situations. That is to say, on the better classes of woodland soil highwoods can be profitably grown with a longer rotation than on poor land; while in copse and coppice the fall can be repeated all the more frequently, the better the quality of the land—because then there is not the same danger of deterioration by frequent exposure.

Unfortunately, no average data on any large scale are as yet available from British woods to prove these facts, though they are matters of common experience in practice. In default of such statistical tables for Britain, it may

perhaps be of some use to give the following as the average annual rates of increase in growth in cubic feet (reduced to the customary British 'square-of-quarter-girth' measurement) yielded by ordinarily well-managed woodland crops throughout the Hanoverian forests:[1]—

Kind of Crop.	General Quality of Soil and Situation for the given kind of Tree or form of Crop.					
	Age of Crop. Years.	Good.	Age of Crop. Years.	Medium.	Age of Crop. Years.	Poor.
Highwoods.		*Growth in cubic feet per annum.*		*Growth in cubic feet per annum.*		*Growth in cubic feet per annum.*
Oak	160	45 to 60	140	40 to 45	120	30 to 40
Beech	140	50 to 65	120	43 to 49	90	30 to 43
Spruce	120	75 to 95	100	64 to 72	70	40 to 57
Scots Pine . .	120	48 to 75	100	40 to 48	60	21 to 39
Copse.						
Oak standards, over coppice of mixture of hardwoods and softwoods	18	48 to 54	20	40 to 42	25	28 to 36
Coppices.						
Oak, with other hardwoods, hazel, &c. .	15	48 to 53	18	about 40	20	21 to 32
Alder (on marshy land) .	25	62 to 79	30	48 to 54	35	24 to 38

Say, for example, that a Scots pine wood which has long been growing actively begins

[1] But see also the statistics given on p. 327.

about seventy years of age to show signs of falling off in growth—*i.e.* to yield less of a return on the capital represented by soil plus growing stock than has until now been the case—then obviously it will be advisable to clear it off and utilise the land for the production of a younger and more vigorous crop.

It would of course be extremely inconvenient —nay, impossible in view of a regularly sustained annual yield—to treat every portion of a large woodland area in this particular manner on its own individual merits, but a general scheme as to rotation of the fall for certain kinds of tree-crops in the given local circumstances can conveniently be arranged and followed. When, these last being duly considered, the kind of crop, the system of management, and the rotation of the fall have been fixed on, the capital in wood must, in order to provide a regularly sustained annual yield, be adjusted and distributed in such a manner that each successive year's fall shall consist of an equal (or, rather, an equally productive) area, while the capital in growing stock must consist of such a number of equally productive areas as

there are years in the period of rotation from one fall of mature crop to the succeeding fall on the same area. In coppice worked with a rotation of ten years there will be ten such equally productive annual falls; in copse felled over every twenty years, twenty such; and in highwoods worked with a rotation of eighty years, eighty such annual falls. And the only proper adjustment and distribution of the capital in timber or other growing stock of smaller dimensions in the woodlands must be that the crops on such equally productive annual falls shall form an unbroken series from 1 to 10, 1 to 20, and 1 to 80 years respectively in the above cases. Without this, regularity in obtaining a sustained yield annually is impossible; and no available market can be utilised to the best advantage if the quantity of wood offered one year is large, the next year small, a third year wanting altogether, and so on irregularly. 'First a hunger, then a burst,' is bad in this as in all other cases.

The proper adjustment of capital in woodland crops is therefore—no matter whether highwood, copse, or coppice be the form of management

adopted—precisely of the nature of a simple arithmetical progression. In the above examples the series of portions of the crops would respectively be aged 1–10, 1–20, 1–80 years just before the fall in each year, while immediately after the fall it would be 0–9, 0–19, 0–79 years, and at midsummer it would be $\frac{1}{2}$–9$\frac{1}{2}$, $\frac{1}{2}$–19$\frac{1}{2}$, $\frac{1}{2}$–79$\frac{1}{2}$ years. Hence, by summarising these series, the necessary capital in growing stock will be found to be in the above cases respectively equal to five, ten, and forty times the amount of that portion of the crop which comes to the fall as the harvest of each year; because what comes annually to the fall as the mature crop, leaving thinnings out of consideration, is the incorporation of the annual growths from time of formation of the crop up to ten, twenty, and eighty years respectively. The correctness of this can be easily represented graphically. Assuming that the total sum of the annual growths incorporated in the mature fall consists of equal annual increments (which is not in reality the case, though this fact does not affect the total volume), if a series be formed of the annual falls of equal breadth this will result in presenting an indented inclined plane. And the

area of this will be calculable (as that of a right-angled triangle) by multiplying the height of the triangle (representing the fall of mature timber for each year) into the base (representing the number of years forming the period of rotation), and dividing the result by two; because the indentations can be eliminated as above shown in summarising the arithmetical progression. From this it will be very clear that the length of rotation not only reduces the area that can be cropped annually, but also adds very considerably to the capital required in timber. Suppose, for example, that there are two estates having each 800 acres of similar land under mixed crops of larch and pine, and that one of them is worked on an eighty years' rotation, with an annual fall averaging 10 acres, while the other is cropped with a rotation of one hundred years, and an annual fall averaging 8 acres; and suppose, also, that the yield of the mature crop is in the former case 7000 cubic feet per acre, while in the latter it is 8500 cubic feet; then, in the former case, the capital required in timber properly adjusted and distributed regularly over equally productive areas coming successively to each year's fall would be—

$$10 \text{ (acres)} \times \frac{7000 \text{ (cb. ft.)} \times 80 \text{ (years)}}{2}$$

= 2,800,000 cubic feet; while in the latter case it would be—

$$8 \text{ (acres)} \times \frac{8500 \text{ (cb. ft.)} \times 100 \text{ (years)}}{2}$$

= 3,400,000 cubic feet. These figures may seem perhaps to suggest that the eighty years' rotation would probably be the more profitable, involving, as it does, so much less capital in timber; but, in the woods worked with the longer rotation, the timber would be of larger dimensions and higher market value. Moreover, a certain portion of the timber included in the mature fall at eighty years of age will likely be cut as thinnings, between eighty and one hundred years, in the longer rotation; and this must of course be taken into account when trying to determine which rotation is the more profitable way of utilising the land. From this it can also be noted how misleading it may be in Forestry, as in other matters, to jump to conclusions on mere *primâ facie* appearances; for the determining of the rotation of the largest probable profit is a matter purely of actuarial calculation, which is to a considerable extent the basis of economic Forestry. In fact,

Forestry, conducted on purely business principles, consists of two main branches. These are, firstly, *the growing of woodland crops*, an art based chiefly on knowledge of Vegetable Physiology, and, secondly, *the harvesting of the crops at the most profitable age*, an economic arrangement determinable absolutely and entirely by local and financial considerations.

It may perhaps be as well to remark that in the above supposititious case the annual yield is really (in customary British square-of-quarter-girth measurement) below the actual yield usually obtained from well-managed conifer woods in Germany; and with good management this should certainly not be less in our climate. Assuming, however, the whole capital in timber to be worth only 3d. per cubic foot, and the mature fall to fetch merely 6d. per cubic foot at 80 years and, say, 8d. at 100 years, then with the eighty years' rotation the entire growing stock of timber would have a capital value of £35,000, and would (along with the capital value of the land) yield an annual return of £1750, or £2, 3s. 9d. per acre; while with the one hundred years' rotation the entire wood-

crops would be worth £42,500, and would bring in a continuous income of £2266⅔, or £2, 16s. 8d. per acre, as the interest on the capital in timber and the rental from the land. 'But,' I think I hear some landowner suggest, 'it seems absurd to have so large a capital in timber on so small an area. One could do much better with it if he cleared the timber altogether, invested the proceeds in other commercial projects, and got whatever else he could from the land.' Not so, however. If all the capital were in the form of marketable timber, the order could, taking advantage of what might seem a favourable turn of the market, be given to denude the broad acres and convert the timber into money; but, as most of the crops must be immature, realisation could only take place at a heavy loss. Timber-growing is not like investments in house-property or shares, which can be changed from time to time as desired. It is essentially of the nature of a permanent, a gradual, and a very rapidly accumulating investment. It should only be embarked upon after full consideration of the matter, and should only be conducted either with personal knowledge or else

under competent advice. No wise landowner would seriously think of investing £35,000 to £42,500 on mortgages or ordinary investments without his lawyer's advice or some other specialist's opinion; and yet many of the large plantations of Britain, amounting to not less in final capital value, have been formed on rather haphazard methods, and are not being managed as well as they perhaps might be.

If the woods and coppices are fully stocked, as should be aimed at under good management, then the necessary capital in the growing crops is equal to the yield of the mature fall of each year multiplied by half the number of years in the period of rotation. If the bulk of the land is stocked with crops younger than half the period of rotation, then the capital in woods or coppices is insufficient to yield the best return from the land in the shape of a regularly-sustained annual yield; while, if the majority of the crops is older than that limit, the capital in timber can with advantage be gradually reduced as such portions come to their maturity and fall. The beechwoods, as managed in portions of southern England, form an exceptional class.

Here the trees of all ages, from the seedling to the mature stem, are grown together on the same area, and the fall extends over a far larger acreage than a mere annual section. This treatment is of course only possible through the beech being able to bear shade well. But, even in this case, the best results will usually be obtainable by division of the forest into blocks, and by treatment of these in regular succession, as previously indicated on page 144.

I am afraid the above is somewhat technical; but if the future market for timber is really going to become profitable, as seems likely, then any indication of the above nature will not have been given in vain if it may perhaps induce landowners and estate-agents to give closer attention to the principles upon which Forestry is based, as distinguished from Arboriculture. And I would particularly desire to draw attention to the fact that, in some respects, growing timber for profit differs essentially from almost any other kind of investment. For instance, the cheapest method of forming woods, successful natural regeneration, under favourable circumstances costing less than sowing and much

less than planting, often builds up the largest possible capital in timber, and gives the best returns, both in the way of intermediate thinnings and of the ultimate mature crop. The main point to be aimed at is the formation of sufficient density in a young wood, with a proper number of stems per acre, and the cheaper this can be obtained the better. But when once this object has been effected, the whole of the subsequent value of the crops—as regards capital in timber, improvement in the value of the land, and ultimate yield in annual income—depends mainly on the manner in which the woods are protected and tended under a well-considered and rational method of treatment. Mismanagement, neglect, and over-thinning may easily, as has not seldom been the case hitherto, reduce the annual income, diminish the capital value of the woods, and dissipate no inconsiderable portion of the productive power of the soil—all owing to interference with the proper canopy of foliage required for the given class of wood. It thus differs *in toto* from Agriculture. When large crops are taken from arable land the soil has to be improved by

manuring; whereas, in Forestry, the larger the crops grown, the better is the land spontaneously manured by the rich fall of dead leaves, and the more thoroughly is the moisture in the soil protected against loss by evaporation through the exhausting effects of sun and wind.

When once coppice or copse has been formed, each rotation, in either case, may involve a certain amount of outlay in filling up blanks and improving the crop; while the regeneration of highwoods is often dependent on a more considerable expenditure, which keeps growing at compound interest until the woods yield a tangible set-off in the way of thinnings. Notwithstanding the drawback that they lock up a far larger amount of capital in growing stock than is required for coppice or for copse, highwoods are yet in the great majority of cases the most profitable kinds of woodland crops. Moreover, they are the only possible form in which larch, pine, and fir can be grown; and these are, for many soils and situations in Britain, the only crops it would be profitable to cultivate on any large scale. No broad generalisation can, however, be made with regard to any such matter in Forestry,

owing to the bulky nature of wood crops and the expense of transport for any distance by land. When oak-bark was well paid, coppices worked in a rotation of fourteen or sixteen years yielded far higher returns than highwoods; and some of the osier-holts in the fen districts give a more handsome profit than oak-coppice ever did. Again, where there is any fair demand for charcoal for gunpowder, or for cigar-boxes, or the like, alder-coppice may also, under suitable conditions as to soil, prove much more remunerative than either copse or highwoods. And in very many parts of Britain copse has peculiar advantages of its own, which make it the system that must find special preference on many estates. The law of entail makes an important difference between timber and coppice, the former being under English law regarded as part of the estate, the money arising from the sale of which is treated as capital on which only the interest is paid to the owner in possession; while under Scots law an heir in possession under an entail can cut the timber as long as his possession lasts. And these points must affect an owner's planting.

One advantage of copse over highwoods is

that an annual fall can be provided for even in small woodlands. For working highwoods properly large areas are needed; copsewoods, on the other hand, do not necessarily require large areas. On comparatively small tracts of two or three hundred acres the management can be so arranged as to yield small annual supplies of timber of various sizes at each fall of the underwood. Another advantage of copse, besides the comparatively small capital which it locks up, as contrasted with high timber forest, is that it is one of the most convenient forms of management under which an unusually heavy fall of timber might perhaps be arranged for to meet the demand of death-duties on a change of ownership in the estate. The utilisation of a large proportion, or even all, of the largest classes of standards would, although of course otherwise to be regretted and a cause of ultimate loss, not produce such disturbance in the general management as if abnormally heavy fellings had to be made in highwoods approaching maturity—though even this might be arranged for, if necessary. Moreover, copsewoods are better suited for pheasants, covert-shooting, and sport generally, than any

other system of management; and this attractive side to them will always receive, as it well deserves, the favourable consideration of the majority of English landowners. And copses are certainly among the most beautiful woodlands that we have. In this respect their charm unquestionably exceeds that possessed by either highwoods or coppice. When to these advantages is added the further fact that this is one of the best ways of growing oak, ash, and larch, the most highly paid of all our woods, there is, apart from mere æsthetic and conservative feelings about the matter, no lack of justification for continuation of this excellent system of management in Britain, even though it be considered from an unsympathetic and almost purely commercial standpoint.

Apart from special local considerations, the growth of oak, ash, larch, pine, and fir is always remunerative in the vicinity of large towns; while in the hop-districts of England the cultivation of small larch poles was once extremely profitable, without any professional skill being necessary to grow them. Of somewhat larger growth, so as to give poles of three inches or more at the top-end, larch is profitable both as posts and as

pit-wood for props in the mines wherever collieries exist, Scots pine coming next to it in demand for this purpose. Indeed, in mining districts almost all sorts of small wood can find a fair market, provided they average about three to five inches in diameter. Apart, however, from exceptional cases, and from purely local considerations as to the market for disposal of the woodland crops grown, continental experience on a much larger scale than is possible in Britain has shown that mixed crops are preferable to pure crops of any one or other kind of trees. Though pure crops are easier to tend, yet the growth of mixed crops is not infrequently better; and, as regards conifers especially, larch, pine, and fir are then less exposed to danger from snowbreak, windfall, insects, and fungous diseases. It would run into too much space to consider, in anything like detail, the conditions under which such mixed crops can best be grown; but it may at any rate be remarked that one of the essential conditions, next to proper selection of suitable kinds of trees for the given soil and situation, is that the more light-demanding tree or trees must either be of more rapid growth in height

than the others, or else that the former must be protected against the encroachments of these latter by means of thinning.

That most of the British woodlands are not stocked with a sufficiently large number of young or old plants to the acre is a fact which applies alike to highwoods, copses, and coppices. And yet, at the same time, on account of the excessive branch-formation favoured under the arboricultural methods hitherto prevailing, it sometimes happens that the woods may even look crowded, which seems rather paradoxical. Woods that have been over-thinned may spread so much in the crown that the damage done can never be quite repaired. And much the same applies to excessively wide planting, particularly with regard to conifer crops, whose dead branches form hard, horny knots in the stem, which depreciate the value of the bole for the market and for technical purposes. To have the best monetary returns from the mature crop it is essential that plantations shall have been subjected to rational treatment from the very time of their formation onwards, because good present and future management is not of itself, in many cases, able to correct the

mistakes of the past. Plantations made at wide distances, such as 6 feet by 6 feet for larch, pine, or spruce, though below normal density up to fifteen or twenty years of age, may, if simply left to grow up close, become overcrowded at twenty to thirty years of age. In such cases the crowding would be solely due to excessive development of branches, and not to any excessive number of stems per acre. Errors of this sort can of course be remedied to a certain extent by thinning. It is also true that thinning is not merely the best means—it is often, indeed, the only possible means—of tending timber crops; but the damage done to timber in Britain by injudicious thinning throughout the last hundred years might probably be moderately assessed at figures which might seem incredible.

In the case of many of the older woods the damage thus done has been so great that but little can now be suggested except to harvest the over-mature, the most branching, and the least satisfactory trees, and then underplant those remaining—or else gradually to clear off the whole of the wood and form a new crop, either by means of natural regeneration or by sowing and

planting. Again, many young coniferous crops formed from about 1870 onwards (after the import duty had been removed from foreign timber) were planted at wide distances with the consequence that some of them, those of pine especially, were long in beginning to form close canopy for woods of their class, and in commencing to clean themselves of their lower branchlets. They are often now just at the stage when they are likely to be very prejudicially affected as to their ultimate value as a crop if the past arboricultural method of heavy thinning be still followed. The best treatment for such plantations lies in the careful retention of the close cover now at length attained, and in the restriction of thinnings to the mere removal of almost suppressed or of diseased poles, as close cover will kill off dead branches in due time. Canopy being thereafter maintained, such woods can be thinned every five to seven years, yielding good returns wherever there is a fair market for large poles, till the time comes when light-demanding crops, like larch and Scotch pine, will do best if partially cleared and underplanted, usually at an age varying from about forty to fifty years, according to the soil and the past

treatment accorded to the crop. In some plantations known to me the ravages of fungous disease have been such that patches of thirty-year-old larch have had to be thinned so freely in the past on account of canker that underplanting is already requisite, even without the clearance of any of the remaining stems, except such as are now also badly cankered.

As already remarked, although highwoods yield on the whole the best returns where a large capital is available for investment in timber crops, yet copse or 'stored coppice' is a system also offering considerable attractions to owners of woodlands which are of too small an area to be worked as highwoods with a regular annual fall. As also in high timber crops, absolute regularity of treatment cannot be effected, nor should it be aimed at, because changes in the quality, depth, freshness, and other physical properties of the soil and situation must of course necessitate corresponding variations as to both standard trees and coppice underwood. And the leading principles are simple; it is, unfortunately, only their practical application which is often difficult. While the local market will mainly

determine the kinds of trees to be favoured as standards, the soil and the situation must determine the kinds which can be grown best and the number of standards that may be allowed to remain with advantage. The better the soil and the more sheltered the locality, the greater the number of standards that can be retained without interfering too much with the growth of the underwood; and the market open for the timber will, of course, determine the time at which the standards should be cleared, as there can be no advantage in growing these to the age of a hundred years if trees of sixty or eighty years give a better profit on the capital they represent. It is true that standards over coppice have always a larger proportion of branchwood than trees grown in regular highwoods, which produce the longest, straightest, and cleanest stems; but notwithstanding this, copse is an excellent method for growing large and valuable oak, ash, and larch, while it allows greater scope to the forester in adapting his stock of standard trees to suit the prospects of the market in the comparatively near future. It is a system of management well suited for the growth of light-demanding trees,

and especially of oak, ash, and larch; while the finest returns will be obtained on fresh soils in sheltered situations, with light-crowned standards and a dense underwood consisting of hazel, ash, sycamore, maple, chestnut, which reproduce themselves freely, and are capable of bearing a considerable amount of shade under such favourable conditions.

In most British copses both the overwood and the underwood show deviations to a greater or less extent from the conditions desirable for economic treatment. As regards the standards, the trees, usually oak for the most part, run far too much into branches, and the boles are defective, while many of them are over-mature, and should have been felled long ago to make way for a younger crop of more vigorous growth. Again, the overwood is nothing like regularly distributed over the falls, and there is no normal gradation of 'age-classes' throughout it. Then the underwood as a rule suffers from being patchy. There are usually blanks here and there, and even throughout the rest of the area the crop is not as thick as it might be; while it not infrequently happens that the stock actually on

the ground is not that which might be grown with most profit on the given soil and situation. Greater attention was given to copses in old times.

These defects of the overwood can only be remedied gradually during successive falls, so as to bring the copse into a normally stocked condition. Something may often, however, be done by judicious pruning to correct the excessive branch development, by the careful and clean removal of lower branches not exceeding about three inches in diameter. The under-side being cut into first of all, to prevent tearing of the bark down the trunk, the branches should be sawn off close to the stem, trimmed smooth, and well tarred to prevent wound-rot; and the tarring should be repeated till the wounds heal and become completely overgrown. But this operation must be conducted cautiously in place of being carried on in a wholesale manner, else the stems are apt to send out a flush of adventitious shoots below the crown, which intercept the passage of the sap in its upward flow, thus causing 'stag-headness' and decay of the top of the crown. Where resorted to, such pruning should take place as early in autumn as circumstances permit

—for after the fall of the leaf the trees contain their minimum amount of sap and moisture.

Apart from such partial remedy, nothing can be done to correct the faults of injudicious treatment. The only complete cure is to utilise over-mature and excessively-branching standards as early as may be convenient, and to replace them by the retention of a better class of overwood. And that takes time. This is also the only way of providing anything like a regular distribution of standards over the area, and a normal gradation of age-classes among the overwood; because it enables the young 'stores,' 'heirs,' 'saplings,' or whatever their local name may be, to be more or less regularly distributed over each fall, in greater or less number, according to the quality of the soil. And in course of time it ultimately provides the regular gradation of standards in classes varying from each other by an age corresponding with the rotation of the falls of coppice and overwood.

Say the local conditions as to soil, situation, and sale of produce recommend a rotation of twenty years, and permit of an overshadowing of

the underwood which may extend to about two-thirds of the area at the time of each fall, then some such distribution of the oak standards may advantageously be aimed at as the following :—

Age-Class of Standards.	Number of Standards selected to remain.	Age. Years.	Average Individual Growing-space at Commencement of each Rotation. Sq. feet.	Total Area overshadowed by the Standards.	
				Just after each Fall. Sq. feet.	Just before each Fall. Sq. feet.
Young Stores .	40	20	25	1000	7000
Double Stores .	20	40	175	3500	9000
Young Trees .	10	60	450	4500	7000
Old Trees .	5	80	700	3500	5000
Total .	75	...	...	12,500	28,000
Proportion of Area overshadowed by Standards (on land of good quality only) .				about $\frac{1}{7}$ of area.	nearly $\frac{2}{3}$ of area.*

* The extent to which overshadowing by the standards is admissible depends greatly on the quality of the land. In the above particular case the land, Blackmoor estate (Hants) is of very good quality. Gilbert White speaks of the soil as being 'remarkable for timber and infamous for roads. The oaks of Temple and Blackmoor stand high in the estimation of purveyors, and have furnished much naval timber.'—But no such ideal regularity as above can ever be had.

As regards the harvesting of such a crop, each fall will every twenty years be carried out so as to try and include :—

Removed during each Fall.			Standards left after each Fall.			Remarks.
Class.	Age. Years.	Number.	Class.	Age. Years.	Number.	
Coppice . .	20	all	Coppice Stools .	...	...	At each fall there will therefore be removed, along with the coppice, *all* the old trees, *an equal number* of the younger trees, *twice as many* double stores, and *four times as many* young stores.
Young Stores .	40	20	Young Stores .	20	40	
Double Stores .	60	10	Double Stores .	40	20	
Young Trees .	80	5	Young Trees .	60	10	
Old Trees. .	100	5	Old Trees. .	80	5	
Total number of Standards felled		40	Total number of Standards left		75	

As ash is now so valuable, and the favourable market for it seems likely to continue and even improve, the retention of ash standards will usually prove attractive along with oak, or in preference to this; while the planting of stout healthy larch here and there at each time of the fall will add greatly to the subsequent value of the overwood. If the standards were to consist entirely of ash, then the number of stores, &c., in the above suggestions might be increased considerably; and mixtures of oak and ash might also allow of a larger number. The better promise of profit held out by ash, indeed, entitles

it to the preference on the whole, not only because of the larger number retainable per acre, but also because, thus grown, it would reach its full maturity at 60 to 80, or at most 100 years, whereas oak would usually require at least 100 years. In many cases, and particularly on a very limy soil, ash standards will reach maturity at about 50 to 60 years of age, when it must be cut out before becoming 'black in the heart' at the lower end of the stem, a disease which often soon spreads upwards to the main branches. Even on the loamy soils that suit it best, it will perhaps be found advisable to remove all the ash standards at the age of 60 to 80 years, leaving the oak to grow into old trees of 100 years of age.

The young stems selected as stores, or 'standels' as they used generally to be called long ago, should be of seedling growth, if available. In any case they should be straight and shapely, with a compact, high-set crown of foliage. At each fall the inferior stems of each class in the overwood should be harvested, leaving only the best grown to attain larger and more profitable dimensions. Where over-mature, broad-crowned trees have to be cut out before the fall of the

coppice takes place in the regular rotation, they should of course be lopped of all large branches and of their crowns, so as to reduce to a minimum the damage done to the underwood when felling.

The defects in the underwoods of most British copses can be much more easily and speedily remedied than those in the overwood. The old manner in which this used to be done, before forestry became a lost art in England, was thus described by Stevenson in his *Agriculture in Surrey* (1813):—

'It is simply by *plashing* the shoots where a vacancy appears. This is done by cutting the shoot about half through with a bill: the shoot thus cut is laid along the ground; at each of the joints a cut in the direction of the bough is made, over which a little fine mould and turf are laid; the shoot is kept close to the ground by means of pegs. At each point, the shoot that is plashed will take root and throw out several saplings. As soon as the shoot that has been plashed appears to have taken sufficient root in each of its points (which generally happens in two or three years), it is entirely separated from the parent stool: after this is done, the shoot itself is divided in every point where it has taken root, and thus several stout and flourishing saplings are procured from one shoot, which are found to thrive better than the shoots managed in the usual manner, and to be less hazardous than fresh planted trees.

'It is not, however, only in the direct advantage of this mode that its superiority consists: it is plain, that whoever

adopts it must pay more than the usual attention to keep the ground clean and dry, otherwise the shoots thus managed would be overpowered and destroyed before they had taken sufficient root. As holding out the necessity of working the ground, therefore, this mode should be recommended and adopted, even though the direct advantages derived from it were less certain and important than they actually are.'

Wherever the copsewoods seem to be fairly well suited for the growth of ash or hazel and hardwoods, these should be encouraged as largely as may be found practicable. Birch, saugh, and aspen should, in such cases, be treated as weeds, and cut out whenever they are found interfering with the growth of hazel and hardwoods; while these latter should be freed from interference by hazel wherever the more valuable species requires assistance in the individual struggle for light and growing-space. Encourage whatever pays best.

If this can be arranged for, it will often be an advantageous and remunerative operation to go over the coppice-woods during the third year after the fall for the purpose of cleaning them of all weeds (including useless softwoods—birch, aspen, willow) interfering with hardwoods, and of thinning out the number of shoots springing from the stools. If this latter operation cannot be

carried out, then the energy of growth often becomes dissipated over about six to ten shoots in place of being concentrated on the more rapid development of from two or three to five or six of the more vigorous stool-shoots. The day for oak-bark being highly remunerative is passed and gone, to the detriment of our leather prepared with tannic extracts. But it is no difficult matter to transform coppice into copse by means of planting, or by 'groving' to change the treatment from copse into highwoods when this form of cropping seems the more advantageous. Sometimes, indeed, coppice still more than manages to pay its way, even though in the great majority of cases the fall in the amount obtainable per square pole or 'lug' of the coppice hags has made this system far from so profitable a form of crop as it used to be. And yet, on suitable land, and in exceptional cases, some forms of coppice can yield larger returns than any other kind of woodland crop. This is notably so in the case of the osier-holts of the fen districts treated horticulturally.

There are three chief kinds of osiers or basket willows, the Common Osier (*Salix viminalis*), with white silky hairs on its leaves; the smooth-

leaved Laurel Osier (*S. triandra*), and the Purple Osier (*S. purpurea*), so called from the colour of its anthers at the time of flowering. But the varieties and the crosses between these are almost innumerable. In the fen country the cost of ploughing or fallowing and trenching land for an osier-holt, and of purchasing and planting the 'sets,' runs from about £16 to £23 an acre. The planting is done in February or March with slips of two-year-old wood from 16 to 18 inches long, of which about 10 inches should be set in the ground. Until the middle of June careful hoeing and forking is necessary, and this costs from £1 to £2 an acre for each of the first two years till the crop comes into bearing during the third year, after which cleaning costs less as the dense and rapid growth of the osiers usually prevents the growth of weeds. In general, however, newly-planted holts do not come into full bearing till their fourth or fifth year. The annual growth of the 'rods' or withies is completed in September, and varies from six to nine feet in length, or even more in the case of vigorous stools. The harvesting begins in January if the holts are not under water or

too marshy, and should be completed before the sap rises, else the stools 'bleed' and the next crop is weak. Their market value is increased by soaking the cut ends in water and peeling the bark off when the water has risen in the rods. The yield of rods is about 150 bunches, which may vary in total weight by so much as from 5 to 10 tons; but they are reduced to about half their bulk when peeled. An average crop consisting of 150 bunches of green rods per acre has a market value of about £15, and if the rods are peeled their value may be increased to nearly £35. Despite the heavy expenditure, much in excess of that for ordinary woodland crops, on planting, tending, harvesting, peeling, rent, rates, and taxes, it will thus be seen that, on suitable classes of land, and within easy reach of a favourable market, osier-holts can prove a very remunerative investment; and more especially so if combined locally with basket-weaving. But the supply of the raw material for the trade, and in fact the trade itself, capable of great extension, is chiefly in the hands of Belgians, French, and Germans. This is, in fact, merely another example on a small scale of our strange national

negligence and our indifference to economical considerations, which permit several millions of pounds sterling to find their way annually into the pockets of foreigners for the purchase of pinewood and fir timber that we might perfectly well grow for ourselves, with untold advantages to the rural population, and to our internal trade and commerce generally.

CHAPTER X

Woodlands, Game, & Sport

IN the first two or three pages of chapter x of *Wild Life in the Hampshire Highlands*, one of the earlier volumes of this Series, Mr. Dewar has stated the case as to woods and game both well and moderately. 'Forestry and game preservation on a really considerable scale do not by any means always fit in well with each other,' he says; while he gives a concrete example, with particular reference to ground game, in which a landowner, on re-entering into possession from his late sporting tenants, wrote in bitterness of spirit that 'this fine old estate, with its beautiful forest and woods, has been eaten up by *Rabbits*, and the mischief done is *incalculable* and *irretrievable*.'

Similar examples could be multiplied to a vast extent. The magnitude of the destruction rabbits can cause was indicated in the evidence given

before the Parliamentary Forestry Committee in 1887. Among other witnesses the Earl of Mansfield's head-forester described how hares and rabbits barked elm, ash, and beech trees of 80 to 100 years of age in the Scone woods, standing upon their hind-legs, and leaving no bark on the stem up to a height of two feet above the ground. There is not an estate in the country where the productiveness of the woodlands can fail to be injuriously affected if preservation and increase of game, and particularly of ground game, is one of the main objects desired by the landowner. And there never has been an estate where a large head of game did not mean damage to the woods and coppices, particularly at the time of regeneration. On the whole, however, plantations are more liable to attack than woods naturally regenerated.

In the very earliest times, as the first two chapters of this volume show, the woods and the royal forests were mainly used for sport as well as for providing timber and fuel. This strong love of sport, and of country life and outdoor amusements generally, has ever been hereditary, and it still constitutes one of the greatest attractions in the possession of landed estates. Nay, there can

Old Park Elms damaged by Rabbits (Belvoir, 1900)

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be little doubt that a love of sport has often saved many a remnant of the ancient woods, which, but for that, would probably have been 'wasted' or cleared when the rage was on for stubbing woodlands and converting them into arable and pasture land. Even in the fourteenth century it had already been found necessary to enclose portions of the royal forests for their 'encoppicement' and regeneration, to obviate great damage from deer and ground game; and later on, during James I.'s reign, the ploughing of the land and the sowing of acorns was ordered in the New Forest for improving the crop and increasing the number of oak in the woods. But, even earlier than that, Tusser had written in his rhyming book on *Five Hundreth Pointes of Good Husbandrie* (1573)—

'If Cattel, or Cony may enter to crop.
Young oak is in danger of losing his top.'

Against such damage, or that done by deer, trees can be protected by a casing of wire-netting or by having thorns tied with wire round the lower part of the stem. But these are methods only applicable to parks and the ornamental portions of estates, and are not capable of being carried out on any extensive scale in the woodlands.

Where a large head of ground game is maintained, careful fencing with wire partly buried in the ground is the only practical means of keeping rabbits inside a warren, or of keeping them out of plantations, and preventing them doing great damage if they abound in large numbers. But such fencing soon runs into a lot of money, if done on any large scale. Where rabbits multiply greatly, stoats and weasels would soon also multiply and maintain the balance of nature, were it not the gamekeeper's duty to prevent that.

But Sport and Forestry are, I hold, by no means incompatible with each other. The only proviso is that the preservation of game must not be on too large a scale if the forests are intended to be worked commercially. I think ample proof of this is given in the forests of France and Germany, those owned by private landholders as well as those belonging to the State, where excellent sport is obtained in conjunction with economic forestry conducted more scientifically, and with greater financial success, than in any other countries in the world. But sport does not necessarily mean rabbits, which the

forester is forced to class as 'vermin' when they increase greatly in number, as they soon do when their natural prolificness is left unchecked. The great continental forests of Western Europe yield sport from wild boar, stags, roe-deer, as well as smaller game, while good mixed shooting is everywhere obtainable near the edges of the woods. That Sport and Forestry are compatible is duly recognised by the State abroad, which determines the head of big game to be retained and to be shot annually; and the shooting is often leased out on easy terms to the head-foresters in charge of the woods, and is much appreciated by them.

In considering the compatibility of Sport and Forestry, it must be borne in mind that the term 'sport' is not subject to any hard and fast, rigid definition. The idea is subject to modification from time to time, and even to a complete change. Breech-loading guns and long-range rifles have entirely revolutionised shooting and altered the idea of a good day's sport. Nowadays it often seems to be less a question of the interest and enjoyment afforded by the day's doings than of the net result attained. This

was some years ago amusingly hit off (with quite another intention, however) by *Punch* in the Frenchman's eager inquiry, 'Hé bien, mon Cher! What Chance? How many Braces to your Bags?'—In the royal forest of Wolmer, a sandy tract in Hampshire extending to about fifteen square miles covered with heath and fern, now bearing pinewoods in parts, though 120 years ago it stood 'without having one standing tree in the whole extent,' Gilbert White tells us how 'This lonely domain is a very agreeable haunt for many sorts of wild fowls, which not only frequent it in the winter, but breed there in the summer; such as lapwings, snipes, wild ducks, and, as I have discovered within these few years, teals. Partridges in vast plenty are bred in good seasons on the verge of this forest, into which they love to make excursions: and in particular, in the dry summer of 1740 and 1741, and some years after, they swarmed to such a degree that parties of unreasonable sportsmen killed twenty and sometimes thirty brace in a day. But there was a nobler species of game in this forest, now extinct, which I have heard old people say abounded much before shooting flying became

so common, and that was the *heath-cock*, *black game*, or *grouse*.'

What would the 'reasonable sportsmen' of those days say to the battue-shooting of hand-fed pheasants and the driving of grouse now so fashionable? It is good *Shooting*, but it is hardly *Sport;* because the old-fashioned idea of sport was that fair 'law' must be given to the game. But is this now the case in battue-shooting and grouse-driving? He was a far truer sportsman who told Gilbert White how, when the eighteenth century was still young, and 'the beechen woods were much more extensive than at present, the number of wood-pigeons was astonishing; that he has often killed near twenty in a day.' Much more consistent, also, with the true idea of sport is the stalking of deer in the treeless forests of the Scottish moors; but the continental method of walking up, or of first marking down and then lying in wait for wild boar, red deer, and roebucks in the woods, is a truer form of sport than that in which successful pursuit of the quarry is usually dependent on rifles having a considerable range. The stalking of the roe-buck in large woodlands is also an enjoyable

form of sport, with many a disappointment just when success seems to be assured. But in order to have first-class sport of this latter kind it is, of course, necessary that the wooded areas be large and compact, so as to provide rest and quietness for the different sorts of big game, and to prevent them from doing much damage to the agricultural crops surrounding the woods. It is only under such circumstances that a stock of wild boar and red deer can be properly maintained in woodlands. After the former had practically been exterminated in all parts of southern England except some of the royal forests, General Howe, early in the eighteenth century, tried to raise a fresh stock in Wolmer Forest from wild boars and sows obtained in Germany; but the agricultural population rose and destroyed them on account of their depredations. Wild boars, red deer, and roe certainly all do more or less damage in woodlands, and particularly the last two; but the damage is much easier to keep within due bounds, while still retaining a fair head of game for true sport, than is the case with ground game. In some parts of the country, however, as in the Scone

woods in Perthshire, roe-deer often prove exceedingly destructive, and at times give as much trouble as rabbits. But, for large coniferous forests in the Scottish highlands and on Irish moors, wild boar and several kinds of deer, 'black game' and 'red game' might well be maintained in economically-managed forests. There, too, the comparatively rare and shy capercailzie as well as the black grouse could be re-introduced on a large scale, while wood-pigeons and stock-doves would increase naturally and furnish sport of a sort really not at all to be despised by any true sportsman.

Sporting considerations have probably hitherto been one of the chief causes of the apathy of landowners towards forestry in this country. They have certainly been the cause of frequent complaints that woods are unprofitable, and that the growing of timber will not pay as an investment. There seems to me, however, to be much confusion about this matter. Landowners who hold this view seem to have formed their opinions without duly considering, or discriminating between, causes and effects. They do not seem quite to realise that

the difference, often very considerable, between what the woodlands might be expected to yield under economic treatment and what the estate accounts actually show as receipts, is what their stock of game costs them to maintain. Nor is that by any means all that their game-preserving really means in decreased income. Well-managed copses can be made to give good pheasant-shooting without their annual yield being appreciably affected, but the case is different with regard to ground game. Anything like profitable management of woodlands is certainly incompatible with such a state of affairs as exists in many of the wooded portions of large estates, where rabbits are permitted to multiply to such an extent that, when deep snow covers the ground, they cause wholesale destruction to the coppices, render natural regeneration of highwoods all but impossible, kill even large trees by gnawing away their bark, and make the formation of new plantations a practical impossibility without considerable expense being incurred in the erection and maintenance of wire-fencing. And it is usually the more valuable kinds of seedlings, stool-shoots, poles, and trees that rabbits

destroy, such as oak, ash, elm, sycamore, maple, beech, and hazel. The soft-barked ash they attack most of all, and this tree is never at any age safe from their onslaught during snowy weather. Often they almost clear the ground of seedlings and young coppice-shoots in the open woods, while natural regeneration and reproduction are vigorous in adjoining patches protected for experimental observation. Conifers are on the whole less liable to be damaged than broad-leaved trees owing to the resin they contain; but larch, spruce, and silver fir are the most toothsome among them while still young and smooth in the bark. Pines generally, and the Corsican pine especially, are less liable to be attacked than any other trees.

It is questionable, indeed, if many landowners have ever calculated, in cold blood and without any sort of preference or prejudice whatever, the true debit and credit of their rabbit account. It would be interesting to know how much the rabbits actually do cost on many estates in loss of income from and damage to woodlands, and in expenditure for wire-fencing and maintenance of rabbit-proof fences. The first cost of wire

netting and posts alone comes to sixpence a yard, and usually more; but even this low estimate means £22, or £2, 4s. per acre, for fencing even an absolutely square ten-acre plot. It is, however, not only in the woods themselves that damage is done by rabbits. They likewise ravage the fields surrounding the woodlands, and there, indeed, very frequently commit havoc to such an extent as to affect the rental obtained from the farming tenants. And even besides this reduction in the true agricultural value of the land, there is sometimes a heavy bill to pay for specially severe damage occasioned in cases where the farmer is persuaded, or induced, not to avail himself of the only true means of protection, namely, that which is afforded by the Ground Game Act, empowering him to shoot down the rabbits on the land of which he is the tenant. I know a case in which a Gloucestershire landowner had to pay £100 some years ago for damage done to fields round a wood of 46½ acres, although there was no intention of preserving the ground game. Inside this wood there were therefore ivy, bracken, blackberries, and many other weeds occupying the soil which should have produced a good growth

of coppice. If a calculation of this sort be made, and a landowner still prefers swarms of rabbits to well-stocked woodlands, well and good; the landowner who can afford to do this nowadays will have many admirers, while a still larger number may feel inclined to envy him. With such a preference for rabbit-shooting, it would be mere waste of money to attempt economic methods of Forestry, though otherwise the prices now already obtainable for well-grown timber, and soon likely to be much enchanced, also offer attractions not altogether unworthy of some consideration.

It is rather a difficult matter to furnish anything like a satisfactory estimate of the loss in yield and income actually caused by rabbits. It is easier to show how they affect the profitable working in the one single item of forming the plantations, leaving supervision, maintenance, and repairs of damage entirely out of consideration. Wire-fenced plantations may often cost up to £8 an acre or more, but they could be formed for less than half that price if rabbits were kept down as destructive vermin. This difference of £4 an acre mounts up, at 3 per cent. interest, to

sums of more than £17½, £23½, £31⅔, £42½, £57⅕, and £76⅘ per acre, at 50, 60, 70, 80, 90, and 100 years respectively; and this is of itself no inconsiderable charge against the future profit yielded by the crop of timber. But, heavy though this item be, it represents nothing like the monetary equivalent of the actual damage often done by rabbits in literally eating away the value of the crop. Of course, however, the cost of fencing and rabbit-wiring decreases greatly when large areas are being dealt with in compact blocks of square shape; but the special outlay is always dead and unremunerative.

Often, too, the conditions under which timber and coppice are sold clash with the possibility of obtaining the full market value for the produce. On estates where game preservation is one of the main objects in view, the forestry work is expected to be carried out between the end of the shooting season and the beginning of the nesting period, so that all thinning, felling, and planting operations have to be crowded into about six weeks of February and March, quite regardless of whether or not that may be the most suitable time for doing the work. It is not the best time,

but it is the only 'seasonable' time from the gamekeeper's point of view. As the trees are felled when getting beyond their dry winter condition (the best time for felling), and as he is forced to remove the timber immediately, the buyer will not give as much for it as might otherwise easily be obtained; and every penny of difference this makes per cubic foot aggregates over £4 per thousand cubic feet. And the loss of one penny per cubic foot forms an item of over £200 sacrificed on any estate where the annual fall amounts to a thousand loads. But the buyer has every inducement to keep to a low offer, as he knows the timber must either be cleared out of the woods before nesting time or else it will have to be kept over for another year, and then similarly rushed on the market. Again, February and March is not the proper time for carrying out thinning operations in young woods—though, of course, in many of these rabbits render thinning quite unnecessary, and often, on the contrary, make blanks that can only be filled up at great expense, if at all. May and June are the most suitable months for thinning in the young woods and plantations, after the late frosts are over for

the year and before the midsummer shoots are flushed. Planting has also to be hurried on without adequate preparation of the soil; and natural regeneration, often the cheapest and best way of reproducing timber crops, is almost out of the question, because the woods must not be disturbed by men delving and trenching during the autumn, so as to let the earth be acted on by frost and air in order that the prepared strips or patches may form a favourable germinating bed for the autumn seed or the sowings in spring. And then, after trouble and expense have been incurred, when the wire fences round young plantations, natural regenerations, or encoppicements are removed and the area is thrown open, the danger from ground game still remains; and one hard winter may result in damage to such an extent that the financial success of that particular crop is practically impossible. To take the case of one estate, out of about a hundred thousand ash recently planted during ten years, to reap the advantages offered by this valuable tree, only a few grew up. The soil being suitable, the plants did well so long as they were left alone, but when rabbits were allowed to get at them

they very soon more than decimated the promising young crop of ash.

Proof after proof as to the destructiveness of ground game could be adduced to an overwhelming extent if it would serve any really practical purpose. There can be no remedy except constant expenditure to repair damage, and usually with most unsatisfactory results; while there can be no real prevention of damage except by shooting down the prolific litttle conies, as has been done in the case of hares in most parts of England, and by keeping them in due check after that. In comparison with the ravages of ground game, the damage done by pheasants in scratching up sowings in nurseries and in woods being regenerated naturally, and that wrought by other game-birds in the forests, is insignificant. This class of shooting need not interfere with good Forestry to any really appreciable extent unless the various necessary operations in the woods are, as is now usually the case, prohibited from being carried out at the seasonable, suitable, and only proper time for conducting them. Such greater freedom for the benefit of Forestry would of course disturb the pheasants, and make them wild

and shy; but it would certainly tend to raise pheasant-shooting once more from its present level of speed and marksmanship up to the higher position it once occupied as a branch of true sport. For such purposes copsewoods have special advantages over highwoods or coppices; and this, along with other advantages previously indicated, entitles this typically British form of forestry to the strongest claim for favourable consideration as regards future management of woodlands on a more economic basis than has been customary in the past. Pheasant-shooting in particular can easily be amply provided for by encouraging the growth of berry-producing shrubs along the edges of the rides or green lanes, useful for autumn game-driving, and necessary in any case for the proper conduct of forest operations according to a fixed plan of operations or comprehensive scheme of management. In large woods special plots can be reserved and specially treated for pheasants by being thrown out of the general scheme of management.

Certainly, if the woodlands in the British Isles be extended so as in future to be able to produce at any rate a larger share of the timber we

annually require in vast and ever-increasing quantity, and if these be managed on economic and not on merely arboricultural principles, true sportsmen will be the gainers, for Sport will then be raised up once more from the rather doubtful position to which it has gradually sunk during the course of the last fifty or sixty years.

It may be thought by many that in the above I have perhaps used unduly strong language in speaking of rabbits as if they are merely glorified vermin. But this they certainly are from the forester's point of view. And the farmer can also hardly fail to class them as destructive pests wherever they occur in any large number, as they soon do if not kept well in check by shooting and trapping. No such statistics are known to me, but it would be interesting to know how many rabbits one acre of ordinary grass land can support continuously. Yet even without such data, one can easily understand that the only innocuous way of raising rabbits for sport is to confine them within properly enclosed warrens, from which escape should not be permitted. It is only thus that any landowner fond of rabbit-shooting can provide sport

of this sort for himself and his friends at his own proper expense, without prejudice to his tenants and injury to all the neighbouring land-owners whose woods or fields march with his rabbit preserves.

CHAPTER XI

The Improvement of British Forestry[1]

TREATED for the most part as coverts, game-preserves, and pleasure-grounds, neither the Crown forests nor the private woodlands of Britain can be expected to give the returns they would yield under better management. Even in cases where timber is grown as an investment, the plantations are as a general rule considerably understocked, often through having been formed at too wide distances to begin with, and then thinned when they were just beginning to remedy by natural means this initial defect; while not infrequently the wrong kinds of trees have been selected for growing to the best advantage on the given land and in the particular locality. It does not follow

[1] See also the introductory Preface.

that because good results are obtained in one locality, equally good results will be obtainable from the same tree in quite a different part of the country. Allowances must be made for climatic conditions, as well as for soil and subsoil. In the woods, too, that can be regenerated naturally, and have thus sown themselves time after time for centuries past, over-thinning has likewise been habitual. In great measure due, no doubt, to almost immemorial custom for the browsing of deer and the formation of coverts and thickets for game of all sorts in past days, this too free use of the axe in immature woods was also more recently meant to hasten on the increase of the trees in girth, thus overlooking the fact that profit in timber-growing may often depend far less on the prices obtainable for a comparatively small number of large trees than on the sum total per acre obtainable for the whole crop of wood of marketable size. The direct consequence of this arboricultural treatment has, of course, been the development of large crowns and big branches. This, though adding to the beauty of any tree as a natural object, distinctly decreases what would otherwise

be its market value as so many cubic feet of timber. And then, too, many of these fine trees, spreading their huge limbs far around them, have often, from one reason or another, been allowed to remain standing long after they have attained their maturity. This is especially the case with many of the beautiful old oak-trees in copses, which have often been rendered almost useless by old age and over-maturity, but which as objects of picturesque beauty possess a value that can well outweigh any financial considerations with a wealthy landowner when such woods are in the immediate vicinity of his mansion. Even when trees are grown for profit, however, the mistake has sometimes been made of allowing the crop to stand after it has attained its full maturity, and when its further retention has really meant not only loss of interest on the capital in timber, but also actual loss, to a greater or less extent, of capital in deterioration of the soil for the production of wood. While old trees and fully-matured crops of this sort are allowed to remain growing, instead of being cleared and utilised, they are both unprofitable in themselves, and they also prevent a younger

and more vigorous crop of wood being grown on the land they occupy. And thus it comes that, except on a very few estates, the woodlands are not being worked in the manner which can be expected to give the best financial results.

That our woodlands, aggregating a little over three million acres, and mostly owned by private landholders, are not in the best condition possible, has long been a well-known fact. In 1885, a Select Parliamentary Committee was appointed to consider the position of Forestry in Britain. After investigating the subject thoroughly for about two years, they reported that 'whilst on public and national grounds timber cultivation on a more scientific system should be encouraged, landowners might make their woods more remunerative were greater attention paid to the selection of trees suitable to different soils and to more skilful management after the trees are planted.' This, of itself, was but the reiteration of the consensus of opinion and of the general feeling on the subject to which expression had already been given in appointing a Committee to investigate and report on the matter. Certain specific recommendations were, however, also made as

regards the State providing instruction in Forestry, but these did not bear the fruit they might have done, and the proposals then made soon became out of date. Although 'more skilful management' was recommended, nothing adequate was at once done to supply the instruction which may develop the skill; for a knowledge of Forestry no more comes by intuition than does skill in Medicine. One can easily, as with drugs, find out what has bad effects, but the correct and beneficial treatment can only be arrived at by sound theoretical instruction, careful, intelligent study, and practical experience and observation of results under different local conditions. If any young landowner, or prospective landowner, or any student of land agency wished to obtain a thorough training in Forestry and the cognate sciences, there was then no institution in the British Isles at which he could get the same except at an expenditure in time and money far beyond the means of most of those who might be desirous of thus studying Forestry as it is studied in almost every other country in Europe. And the practical result of want of such opportunities in the past is that our wood-

lands, even when managed mainly on what were considered business principles, are nothing like so well stocked or so profitable as they otherwise might have been.

A singular and very convincing proof of this was given, in 1899, at a discussion on Forest Management at the Surveyors' Institution, when Mr. Daniel Watney, the well-known authority and expert on British timber, remarked that—

'In a paper read by Professor Fisher of Cooper's Hill before the Dublin Royal Society, it was estimated that there were 4,000,000 acres in Great Britain and 2,000,000 acres in Ireland which were available for planting, and, as he gathered from the report he had seen of the paper, these 6,000,000 acres were expected to be capable of yielding 75 cubic feet per acre per annum. He could not quite understand this, for if these 75 cubic feet were put at the price of 6d. a foot even, the yield would be 37s. 6d. per acre per annum.'

The best continuous annual returns known to him, Mr. Watney then continued, were those of 30s. an acre yielded by beechwoods in Buckinghamshire (see page 140). Yet I venture to say that an anticipation of 75 cubic feet per acre is quite justifiable as an average annual yield. Often much over 100 cubic feet *in actual solid contents*—and therefore still considerably in excess

of 75 cubic feet even if all be reduced to correspond with the *customary British* (*square-of-quarter-girth*) *measurement*, which makes an allowance of 21½ per cent. for wastage in conversion—is not an unusual yield for conifer crops (larch, pine, and fir, each of them) on good soil. Indeed, this quantity is often far exceeded on good forest-land in Germany. And, as we have equally good soil and a climate rather better than that of Continental Europe for the growth of timber in general, it must be due either to want of technical knowledge, or to insistence on wrong methods, or to some combination of both of these causes, that our coniferous timber crops do not, within Mr. Watney's extensive experience, give so good a yield as is common throughout Germany. This may be seen from the data already given on page 266 for Hanover; but similar data collected in other parts of Germany and tabulated for local use, all show that this result is attainable under good economic management. That such is the case may be seen at a glance from the Tables of Average Yield per acre used throughout Germany (see page 327). But I must apologise for thus once again bringing for-

ward German Forestry statistics in default of any being as yet available for Britain. In doing so, I would merely re-echo the words of the Earl of Rosebery (in connection with quite another matter) on 23rd January 1900: 'I say this, that we are a people of enormous waste. We waste simply by not pursuing scientific methods. I do not like to compare us with Germany; but, at any rate, we may be certain of this, taking Germany as an example of the opposite method of treatment, Germany is infinitely more painstaking in her methods than we are. But without taking as a model Germany or any other country . . . we must become more scientific in our methods.'

By means of such statistical tables, based on the average of thousands of crops of timber, and compiled from data collected in different parts of the German Empire, the returns which should be given can be forecast if the quality of the soil and situation are known; or the latter can easily be determined by the actual amount of wood yielded on felling a mature timber crop that has been properly managed. One particular lesson that can obviously be drawn from them is the great advantage to be obtained by suiting the

Table of Average Yield per acre for Highwoods throughout the German Empire (including all wood, except stumps and roots).

TOTAL AVERAGE VOLUME (TIMBER AND SMALL WOOD) IN CUBIC FEET, ALL OF IT (INCLUDING EVEN SMALL WOOD) BEING REDUCED TO CUSTOMARY BRITISH MEASUREMENT (SQUARE-OF-QUARTER-GIRTH, OR ONLY 79½ % OF ACTUAL CUBIC CONTENTS).

Kind of Crop.	Age in Years.	Quality of Soil and Situation for the given kind of tree.					
		Very Good.	Average Annual Growth.	Medium.	Average Annual Growth.	Very Poor.	Average Annual Growth.
			Cub. ft.		Cub. ft.		Cub. ft.
OAK.	60	2,620	44	1,710	28	640	10
	80	4,000	50	2,570	32	940	12
	100	5,500	55	3,450	34	1,400	14
	120	7,070	59	4,330	36	1,420	12
	140	8,550	61	5,150	36	1,610	11
BEECH.	60	3,150	52	1,930	32	630	10
	80	4,940	62	2,950	37	920	11
	100	6,770	68	3,970	39	1,180	11
	120	8,360	70	4,810	40	1,340	11
	140	9,680	69	5,470	39	1,440	10
SCOTS PINE. (*Weymouth* and *Corsican Pine* should give a larger yield.)	20	1,180	59	730	36	240	12
	40	3,410	85	1,990	49	580	14
	60	5,700	95	3,290	54	920	15
	80	7,700	96	4,420	54	1,220	15
	100	9,290	93	5,320	53	1,470	14
LARCH. (*Japanese Larch* will probably give only a smaller yield.)	20	1,490	75	900	45	280	14
	40	3,820	95	2,200	55	620	15
	60	6,160	103	3,480	58	920	15
	80	8,050	100	4,530	56	1,180	14
	100	9,570	95	5,370	53	1,390	14
SPRUCE. (*Douglas Fir* and *Menzies Spruce* should give a larger yield.)	20	1,130	56	730	36	260	13
	40	3,490	87	2,050	51	610	15
	60	6,360	106	3,580	59	940	15
	80	9,230	115	5,100	64	1,240	15
	100	11,780	117	6,420	64	1,500	15

kind of crop to the soil and situation rather than by trying to grow the kind of tree that

commands the best price per cubic foot at the moment. Thus, what is classifiable as 'poor' land for oak or beech may be 'medium' or even 'good' land for pine, and would consequently in all likelihood give far better ultimate returns if thus cropped than by utilising it for the growth of hardwoods. And, in either case, an admixture of larch, on land suitable for its growth, will both improve the woods and add to their monetary returns. Suitability of soil and situation should therefore be the first consideration in determining the specific nature of the crop, if the timber it will yield is at all marketable locally; because, while the growth is most energetic, the quality of the wood produced is at the same time better for general purposes, and its market value is consequently greater.

These tables also show how conifer crops have the power of almost trebling the capital in wood during the period of greatest activity in upward growth between twenty and forty years of age, a point which has been previously remarked on. But, obviously, in order that the gross capital in wood may accumulate rapidly, and that the advantages of a regularly sustained annual yield

may be gained, it is necessary that the formation of timber crops, including plantations on land again being brought under wood after agricultural or pastural occupation, or after having been 'wasted' and allowed to revert into wild moors or bogs, should be continuous year after year. Without continuity the best results are not obtainable, for the capital in timber cannot then be adjusted and distributed over the area to the greatest advantage. It is only by regular annual continuity in forming plantations that the requisite capital in timber for large woods can be gradually built up—and this, owing to the rapidity of growth during the pole-forest period of young woods in close canopy, at a far less actual outlay than such capital, when fully provided and properly distributed, is really worth in monetary value estimated on its capacity for yielding annual returns. At the same time a by no means inconsiderable 'unearned increment' takes place in the capital value of the land bearing well-managed woodland crops, as the dead foliage of thick woods in close canopy improves the land by forming *humus* or mould. This directly increases the productive capacity of the soil, and consequently

raises its monetary value as judged by the practical standard of fertility. And a fact worth noting in this connection is that, on land again being brought under wood long after its original clearance, the necessary capital in timber can in favourable circumstances be built up at the least expenditure in money, though not in time, by means of sowing in place of planting; while sowings, which come up thickly, will always yield earlier and considerably larger thinnings than plantations, unless these should happen to have been made very closely, and at a cost almost prohibitive in Britain. In our damp climate, however, the strong growth of grass and other weeds that overrun the soil makes sowing far less likely to be successful than in drier Continental countries. And in this class of woods of twenty years of age, after the first thinnings have been made, the number of poles retained so as to form close cover with proper utilisation of the soil usually exceeds considerably the whole initial number of plants with which plantations are generally formed in Britain. The influence of this can even be felt not only as regards the actual capital in timber, but also

as to the income subsequently yielded by the woods.

The consideration of these various matters will show that, for really economical treatment of woodlands, a well-considered Working Plan or Scheme of Management is necessary in the case of estates having any considerable acreage under timber. The idea of having Working Plans of this sort for the woodland portions of large estates in Britain is as yet comparatively new, and it is consequently not yet generally approved. The necessity for having any regular Scheme of Management, to be adhered to year after year so far as desirable, is not yet quite understood; hence it is suspected that its provisions would more probably hamper than assist towards the better management of the estate. This objection, however, overlooks the fact that the object of a Working Plan is that any landowner who wishes to grow crops of timber in a commercial manner may have the forest work on his estate arranged so as to give effect to his wishes in the best and most profitable way. It only aims at effecting improvements wherever necessary in the treatment of the existing woodlands, and it

makes such suggestions with regard to the formation of new crops as may lead to the land being utilised to the best advantage. By grouping the different woods into blocks, by considering and fixing the best periods of rotation, and by judicious allocation of the annual thinnings and the falls of timber and of coppice, a Scheme of Management should strive to realise, as fully as is practicable, the desire of the landowner, and to obtain for him the largest returns which the land can be made to yield in the shape of a regular yield sustained year after year. Even details have to be fully considered, as, for example, providing timber-roads and edge-shelter of thickly-foliaged evergreen trees along all the sides of woods exposed to the deteriorating influence of heavy winds. In various other minor matters there may also be room for improvement. Thus, timber is often sold standing, and the buyer carries out the felling. Even if the latter employ the woodmen on the estate to do this, as is often the case, the work is not likely to be so carefully performed, or the damage to underwood or young growth minimised so effectively, as if the operation were conducted directly for the proprietor,

and by his own men working under the personal supervision of the wood-reeve. The selling of standing trees survives from ages ago. Even in Evelyn's time its drawbacks were recognised, as when he says of the oak, 'A *Timber-tree* is a *Merchant Adventurer*, you shall never know what he is *worth*, till he be *dead*.'

Most British woods are unfortunately in such a condition that Schemes of Management drawn up for them will not at once lead to more profitable returns being obtained from the woodlands than hitherto, because in the vast majority of cases the capital in timber is not adjusted and distributed economically over the woodland area. Often, indeed, additional expenditure will have to be urged for the filling of blank spaces in thin crops, and thinnings will usually have to be restricted considerably in comparison with what has been hitherto customary under the arboricultural method of treatment. But these are the results of uneconomical management in the past: they are not faults inherent in a methodical Working Plan. Hence it will often happen that the benefits of a Working Plan will not become apparent till such proper adjustment and distribution of

the capital in wood has taken place, and till the various crops have been brought into such density of cover and general economic condition as may be essential for subsequently obtaining the largest annual yield capable of being regularly sustained. Until this is achieved, the effect of a sound Scheme of Management can only be in the first instance to gradually increase the capital in timber, and consequently the capital value of the woods, till that is properly distributed over the area. But, it has been said in objection to such Schemes, the estate may change hands from time to time, timber has to be felled to meet the death dues, and then what becomes of all the fine arrangements of the Working Plan? Of course, if the woodlands are to provide the money, the Scheme of Management cannot then be carried out in its original form. It is almost certain, however,—indeed, it stands to reason—that woods being managed under a well-considered scheme are much more likely to be able, without permanent damage resulting therefrom, to provide for such a contingency than woods worked almost in a haphazard way. Larger fellings might, for example, be made in the almost mature woods, with

a diminution of subsequent falls for some years till this premature eating away of some of the capital be made good again by savings; so that, if the woods are as a rule to be looked to for providing payment of death dues, this seems rather a recommendation for economic management than a valid argument against it.

Another objection that has been raised is that Working Plans may be all very well for State forests, but they are not so suitable for private estates. This objection, likewise, rests on the misconception that on the Continent the great bulk of the forests is the property of the State. Such is not the case. All the private woodlands in Germany are managed in accordance with definite, carefully-prepared Working Plans, and some of the great landowners like Prince Stollberg-Wernigerode on the Harz Mountains maintain quite a large establishment of highly-trained and well-paid forest officials. That success is a mere question of management, and not of the total amount of woodland area, is proved, if specific proof were needed, by the fact that the Belgian forests, aggregating 1,750,000 acres, give a return of four million pounds sterling a year.

Now, if our 3,000,000 acres of woods and forests were equally profitable, they would bring in an annual income of nearly seven million pounds. Nothing like these results can, however, be obtained unless the woodlands be subjected to well-considered management in the manner above indicated. During recent years, since 1897, steps in this direction have been taken by the Commissioners of Woods and Forests for some of the Crown lands, and also by a few of the large landowners in Britain, who recognise the solid advantages that economical treatment promises, more especially with indications already present of considerable enhancement in the market value of clean, well-grown timber. And, as regards the Crown forests, no doubt larger areas would already be subjected to improved treatment but for the circumstance that in many ways the hands of the Commissioners and of their Deputy-Surveyors are tied by Acts of Parliament against the clearing of over-mature timber and the enclosure of portions for regeneration or planting, so that they are unable to carry out the various improvement schemes which they know to be very desirable. As an example of this, the Honourable

Gerald Lascelles, Deputy-Surveyor of the New Forest, in 1887 gave evidence before the Forestry Committee to the effect that more than 40,000 acres of the forest land had been lying waste there simply because two clauses of the Act of 1877 prohibited clearing and planting being done.

One peculiar feature of Forestry in Britain has previously been remarked on (p. 274), namely, that landowners have hitherto usually entered on an investment of this permanent nature without obtaining such professional advice as they would, as a matter of course, seek in investments of any other nature. And a further development of this same national peculiarity, this 'waste simply by not pursuing scientific methods,' as Lord Rosebery put it, this neglect of the business side of Forestry, is that the men placed in charge of the woods, besides having formerly been unable to obtain a sound and comprehensive technical instruction, practical as well as theoretical, are still much underpaid considering the responsibilities some of them must have. Thus, for example, a case was mentioned in 1900 at the Surveyors' Institution, in which one landowner in particular, who was

getting more than a thousand pounds a year out of his woods, paid his forester 15s. a week! Now, at 3 per cent. this income would indicate a capital of £33,333 in woodlands; and to expect to have this large capital administered to the best advantage,—with probably fair scope for increasing the capital by skilful management, and thereby likewise increasing the annual income yielded by it,—for the sum of £39, 7s. 6d. a year paid as wages to the wood-reeve, does not seem quite in proper proportion to the nature of the services desired and apparently expected of him.

It can hardly be denied that British landowners, as a class, are decidedly apathetic with regard to Forestry. So far as game-preserving is antagonistic to good management of the woodlands, that matter has been fully dealt with in the last chapter. Other three causes, perhaps in some cases equally powerful in this direction, are want of funds, want of encouragement offered by the State to induce landowners to plant waste land, and danger of fires along railway lines. One great opportunity for State encouragement of economic Forestry was

lost by those in power, when the Congested Districts Act for the Highlands was passed without favourable consideration having been given to the recommendations made on this particular matter, as well as on planting along the west coast of Ireland, by the Forestry Committee of 1887. But action now seems probable, owing to the new interest awakened with regard to Afforestation (see the introductory Preface).

As most landowners have merely a life-interest in their estates, and as the calls on their purse are many (beginning with the heavy demand on succession), they have not as a rule much money to spare for forming plantations which are only likely to yield substantial returns after their individual tenure of the estate is at an end. Hence, even if he be convinced of the desirability of growing crops of timber for future profit, the landowner seldom has the funds necessary to make an investment of this sort. It should not be impracticable that advances might be made from the Treasury to landowners desirous of planting waste lands and tracts thrown out of arable or pastural occupation. And substantial assistance and encouragement

might be given indirectly by amendments to the Lands Improvement, the Settled Estates, and the Board of Agriculture Acts. Under the Improvement of Lands Act, 1899, the Board of Agriculture may extend the period of charge for loans obtained for planting for shelter, or for any beneficial purposes which will increase the permanent value of the land, up to forty years; and the rent charge made by the Scottish Drainage and Improvement Company to repay capital and interest within that maximum period is £4, 11s. 6d. per cent. per annum, payable half-yearly, for advances of £300 or upwards. But such help hardly goes far enough to induce impecunious landowners to form economic woodlands on any large scale. For at least ten years, and often for twenty years, or even longer in some parts of the country, there would be no returns at all, or next to none, from the young woods. All would be outlay. And besides that, there is hardly any highwood crop which can be considered to have reached its financial maturity at forty years of age; hence, for timber crops, the maximum period of the loan might safely be extended so as to lighten the burden during

the first ten or twenty years on the landowner desirous of making such an investment for the benefit of his sons or grandsons, and indirectly for the good of the country in general.

The second of the three causes is the minor matter of the rating of woodlands. Formerly, before the duty was taken off foreign imports of timber, the British woodlands paid no rating. The law regarding the rating of woods is that the value of the land shall be taken at what the soil might be worth in its unimproved condition as agricultural land; but, in practice, a much higher assessment is often made on what is more or less of an agricultural basis. In one instance, in the case of woods on an estate in Gloucestershire about the year 1887, the assessment was submitted to arbitration, with the result that it was reduced from £1591 to £916, accepted by the complainer; yet the arbitrator recorded his opinion that the reduced assessment was still too high. Even if the rating were altogether abolished, the loss would not be much felt by the Treasury in view of the vastly greater benefits that would accrue to the country by growing timber and affording more employment

to the rural population. Or, at any rate, the payment of the rates might be made deferable till the crops are mature and about to be felled and utilised.

A third cause, especially important in conifer tracts, is that though the owners of traction engines or road locomotives have long been liable for damage caused to fields or plantations by fires ignited through their sparks, yet a *Railway Fires Act* was only passed in 1905, and under it damages are limited to £100 only in each case.

The weak points of British Forestry are now much better known and more generally acknowledged than was the case but a few years ago. And the best remedies are being adopted in providing improved technical instruction, both theoretical and practical, so as to supply well-trained, skilful wood-managers and wood-reeves for the better management of existing woodlands. But greater encouragement and assistance must be given by the State to landowners than have yet been extended to them, to induce them to form plantations on poor land and 'waste' tracts once under woods. Given these, there can be little doubt that the good prospects of the timber

market of the near future may soon lead to considerable improvements in British Forestry, without appreciably affecting the maintenance of a reasonable head of game of all the better sorts to satisfy the true sporting tastes of the English Country Gentleman.

It stands to reason, however, that if any extensive and truly National Scheme of Afforestation and Timber-planting is to be seriously considered and engaged in, the business must be taken in hand mainly by the State itself. For the State is the only landowner that never dies, is never called upon to pay succession and estate duties, and is never forced to look for something like immediate returns from the financial investments which it deems judicious to make for the national benefit.

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THE END

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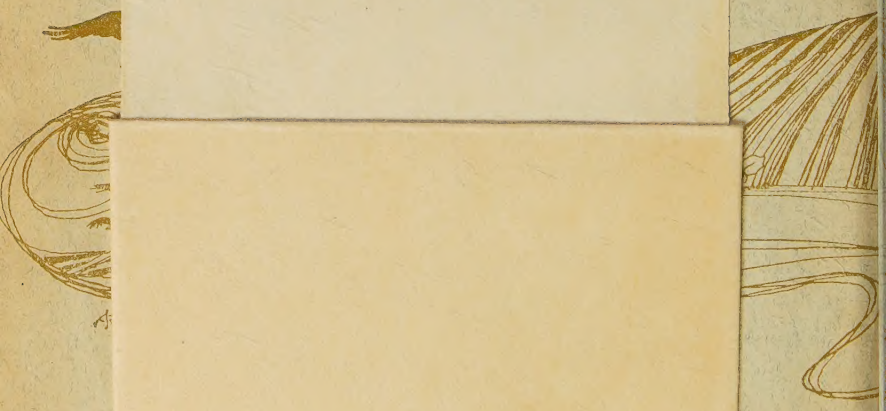

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